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THE EXCURSIONS OF THE GEOLOGICAL SOCIETY OF FRANCE FOR 1878.

BY E. D. COPE.

THE Geological Society of France, though well known in the United States as a publishing body, is not so well known as a school of experts who give practical instruction in their science. In their annual excursions they offer opportunities for acquiring special knowledge in geology of peculiar value. The present season the excursions were arranged in view of the presence of numerous foreigners for a limited time in Paris, so as to exhibit the geology of the country near to, or within easy reach of the capital. There were seven in all, and each one was in charge of a competent geological instructor, while the financial department was under direction of the indefatigable treasurer of the society, Dr. Bioche. A better opportunity of becoming acquainted with the standard of classification of the Tertiary formations which France furnishes to the world, could scarcely have been presented; while the series of beds of the Cretaceous and Upper Jurassic formations visited by the excursionists is, in many respects, very complete. The explanations on the ground furnished by the masters of the subject was all that could be desired for clearness and pains-taking. The leaders of the excursions were Messrs. Hèbert, Lapparent, Tournouer, Vèlain, etc. Among the excursionists we noticed, besides the resident members; M.M. DeWalck, Rutot and Lefevre, of Belgium; M. Stephanescu of Belgrade; M. Renevier, Lausanne; Prof. Guisgardi, Naples; Profs. Almera, Barcelona, and Eulate, Madrid; Fontannes, Lyons; Matheron and Saporta, Provence, and many others.

The first expedition was in the immediate vicinity of the northwest part of Paris, to Vanves, Meudon and Bellvue. At the first

named locality, a beautiful section of the Lower Eocene or Suessonien was examined, which displayed principally the Argile Plastique, below the thin beds of the Lignite of the *Coryphodon*, *Gastornis* and *Palæonyctis*. The whole was crowned by massive beds of the Calcaire Grossier of the Middle Eocene, with its numerous invertebrate fossils. I viewed these exposures with great interest, as the formations contain the remains of a fauna which I rediscovered in New Mexico in 1874. By this discovery I was able to identify the Wasatch horizon of the Rocky mountains with the Suessonien, thus establishing a basis for comparison of formations above and below it, a want not a little felt in North American palæontology. But how different the petrography of the Paris basin from that of North-western New Mexico. Here a thick bed of tenacious lead-colored clay is surmounted by a stratum of more or less impure lignite; in New Mexico heavy beds of hard sandstone alternate with still thicker red and yellow strata of arenaceous marl.

The Calcaire Grossier here yielded its numerous *Echini*, *Cardita planicosta*, *Nautilus*, etc. Further on, along the road towards Meudon, its softer beds formed the banks on either side. Here they were almost composed of two species of *Nummulites*, *N. lævigata* and *N. lamarckii*. Still beyond we visited one of the quarries whence had been obtained many huge blocks of the soft limestone from which so large a part of the city of Paris has been built, and to whose yielding qualities so much of the architectural beauty of the Capital of France is due. Here some of the desolating effects of the German siege were still to be observed. The lowest Suessonien, the Marnes Strontianiferes with their curious mixture of the marine and fresh water shells of the Calcaire Grossier and sands of Rilly, recently discovered, were passed as a white bank on the side of the public way. At Meudon the upper beds of the Cretaceous came in view. The contact of the Pisolitique (Mæstrichtien or Fox hills) with the Marnes Strontianiferes above, was noted as the point of separation between the Tertiary and Cretaceous series. The situation is as though the Wasatch rested immediately on the Fox Hills beds, without the intervention of the great Laramie series; although the Marnes must be regarded as lower in the scale than the lowest Wasatch yet found in North America. A fine exposure of the Chalk, with its characteristic fossils, succeeds the Piso-

litique downwards, and various characteristic fossils were found, including previously unsuspected species of the American genera *Empo* and *Saurodon*.

An agreeable feature of the occasion was a lunch offered by Prof. Chancourtois, member of the society, in his garden at Meudon, which was appreciated as such occasions generally are by hungry geologists.

The excursionists then examined the orange sands and sandstone of the Lower Miocene, at Bellevue, called the Sables de Fontainebleau, well known as the horizon of the *Halitherium*. From this point the quarries of the upper beds of the Lower Miocene, of the Meulières de Beauce, were visited. This formation, extensively distributed near to Paris, consists of red and yellow clay, filled with large siliceous concretions which contain the casts of great numbers of seeds of *Chara* and small *Lymnacæ*. At this locality it forms the summit of a hill, from which a magnificent view of the country to the eastward is had. At its foot is the valley of the Seine, abounding in villages, villas and vineyards, and on its opposite side a range of hills bounds the horizon. The most elevated portion of the ridge bears the fort and hospital of Mount Saint Valerien.

The second excursion was to Etampes, Morigny and Jeurres, at a distance of thirty-five miles from Paris. It passed over the Miocene beds above mentioned, and visited some richly fossiliferous localities of the Sables de Fontainebleau.

The third excursion was to Maignelay, at about the same distance from Paris, where the party explored the lignites of the Suessonien, and the lowest bed of that formation, the Sables de Bracheux.

On the 9th of September the excursionists took the rail to Gournay, on the border of Normandy, from which point they passed on foot and by omnibus over a hilly and beautiful country. The region is rich and one of the most beautiful in France. The farmers have left and planted many trees, and the agriculture is of a superior character. Here under the direction of M. Lapparent, the party viewed the outcrops of the Kimmeridge, Portland, Neocomien, Greensand, Gault, and Cenomanien, and collected *Trigonia, Gervillia kimmeridgensis, Hybodus, Terebratula*, with numerous species of *Ostræa*, and *Exogyra*, etc. The dinner

at Gournay at the close of the day was an enjoyable event, and was enlivened with toasts and speeches.

The excursion of the 11th of September was again in the immediate neighborhood of Paris, and had for its object the examination of the famous series of the Gypsum. Passing by rail to one of the suburban stations, the party followed on foot the course of the Seine to the village of La Frette. Here a steep bank, having at a distance much the appearance of a terrace, forms the lower part of the boundary of the river valley, passing behind the village of Sarcouville and extending along the foot of the ridge which here separates the valley of the Seine from a valley immediately to the east of it. The escarpment of this ledge does not exceed twenty feet in height, but it displays a beautiful section of that part of the middle Eocene known as the Sables de Beauchamp. As it offers a good illustration of the manner in which the Tertiaries of the region of Paris are subdivided into thin beds, which represent frequent changes in the character of the water and of the sediment, I give them as explained on the spot by Dr. Vèlain. The lowest bed is a marine sandstone which becomes brackish in its superior part, and contains *Ostrea cucullaris*. Reposing on it is a limestone of lacustrine origin, containing *Lymnæa arenularia;* in a part of the escarpment this bed is wanting. It is succeeded above by a thin bed of scarcely adherent sand, containing *Melania hordacea*, and believed to have been deposited in brackish water. Above this is a stratum of compact marine limestone containing *Cytherea elegans* and *Potamides*. A lacustrine limestone called the Calcaire de Ducy rests on the marine limestone. This bed repeats the second bed of the series in the possession of the *Lymnæa arenularia*, the specimens presenting a slight varietal difference. It is this formation which contains the oldest remains of *Palæotherium*, as I was informed. In the locality described, the soil of the ascending face of the hill conceals higher beds from view, so that it became necessary to pass to other localities in order to study them.

The party accordingly ascended to the crest of the water shed, passing through orchards and vineyards on its slope. The apples were abundant, but not of good quality. On the summit stood a ruined windmill, forming a landmark, and near it a restaurant and cafè commanding a beautiful view of the rich and populous valley on its north-east side, and of the hills beyond. From this

point our route lay again through vineyards and low forest, and along a public highway. Here piles of the meuliéres of the Lower Miocene of Beauce, containing myriads of *Charæ* and *Lymnaeæ*, with the solid bed of the road, testified to the value of this material as a macadamizer. At length we reached the part of the hill which overlooks Sannois, and descending, examined a complete and beautiful exposure of the gypse and other strata of the Upper Eocene. On the most elevated ground we had the Meuliéres de Beauce, and then in the descending order, the Sables de Fontainbleau with *Cytherœa incrassata*, and *Ostrea scitula*. Then a greenish bed of strontianiferous marl, and below it a few feet of clay containing gypsum crystals and fish bones, with *Cyrena convexa*. This stratum terminates the Lower Miocene, resting on a lacustrine bed which is referred to the Eocene. It consists of marl and soft limestone containing *Lymnæa strigosa*, from which shell it takes its name. With it occur the vertebræ of birds and remains of *Xiphodon gracilis*, which belongs especially to this horizon. The *Lymnæa strigosa* marl lies immediately on the gypsum, of which the escarpment at the quarries of Sannois is about one hundred feet in elevation. The material of this celebrated deposit differs from that of Nova Scotia, Virginia and New Mexico, in its waxy color and coarse fracture. Its continuity is interrupted by two beds of white limestone of no great thickness, and at its base is found a heavier bed of marine origin containing *Pholadomya ludensis*. This in turn rests immediately on the "Calcaire de St. Ouen," which is followed in descending order by the Calcaire de Ducy. This was the superior member in the section of La Frette already mentioned, so that with this junction we completed the series of the Upper, and a large part of the Middle Eocene, with much of the Lower Miocene. To connect fully the Middle and Lower Eocene was the work of another excursion, viz: that to Compiégne. From the upper part of the gypsum, at Sannois, I had the gratification of obtaining portions of both jaws, with teeth, and several bones of a *Palæotherium medium*.

Compiégne is a small town at a distance of about a two hours' ride to the north of Paris, on the Northern railway. It is situated on the border of the forest of the same name, and was the favorite autumn residence of Napoleon III. The excursion passed by public conveyance for about two hours through the

forest to Pierrefonds, on the opposite side. This place is a large village, and is celebrated for its immense chateau which stands in the middle of the town. It dates from the fourteenth century, and was restored during the late superintendency of M. Viollet le Duc. From this point the excursion passed on foot, accompanied by the carriages, entirely through the forest in a new direction. The general inferiority of the timber in size and variety, to that to which the American is accustomed at home, was very obvious. It protects several species of deer and numerous wild boars. Wolves are said to be still found there, and I was informed that they had considerably increased in numbers during the late war with Germany.

Between the Calcaire Grossier and the series of the Suessonian or Lignite and Argile Plastique, is an extensive series of sands and sandy marls which are not present in the exposure seen at Vanves during the first excursion. They are called the Sables de Cuise and are referred to the upper part of the Lower Eocene or Suessonian. The present excursion had for its object the examination of this formation. We first found it in banks on the road side, where great numbers of *Cerithia*, *Turritellæ*, etc., lay exposed. Our collectors could hardly leave these for a small quarry off the road, where incredible numbers of these shells, with *Carditæ*, *Solaria*, *Trochi*, *Neritinæ*, *Dentalia*, etc., etc., covered the mounds that stood around or could be sifted from the banks. This is one of the classic localities to which, as to many others visited by these excursions, the palæontologist turns with something like reverence, as the sources of our first knowledge, and hence the standard of comparison for later times and other countries; in fine, as the field of the daily labors of the fathers of palæontology, Lamarck, Deshayes, Cuvier and De Blainville.

Leaving this attractive locality, the excursionists passed to some high banks of sand bordering other roads. This stratum is one of the lower members of the Middle Eocene or Calcaire Grossier in the wide sense. Here we found abundant teeth of sharks, *Oxyrhina*, *Lamna*, *Otodus*, etc., with spines of *Myliobatis*. We soon after took our carriages for the return to Compiégne, which we reached in time for dinner. Our arrival in Paris was late in the evening.

RELIC HUNTING ON THE MOHAWK.

BY S. L. FREY.

IN these latter days there has been a great impetus given to the study of archæology, and many astonishing discoveries have been made by men digging in the dust and rubbish of the past.

We have all been interested in the stories of Schliemann and Di Cesnola, and have looked with much curiosity upon the valuable treasures they have unearthed. Men like John Evans and Boucher de Perthes have, by their study of the implements of the Stone Age, thrown a flood of light upon the pre-historic times of Europe, and the controversy concerning the age of man upon the earth, which now waxes so hot, will doubtless eventuate in approximately determining that question.

The golden wonders of Mycenæ and the bones of Agamemnon, "King of Men," are certainly worth digging for; terra-cottas from Cypress, and statues from Olympia, and Babylonian tablets take us back into the far past, and rough flints from the caves and gravel beds may lead us to look upon the palæolithic man as a brother.

But while everybody has heard of these strange discoveries in the "far countries," very few know anything about the antiquities of our own country, or of the relics of the Stone Age that lie scattered over the fields all about us.

I have been so much interested myself in the relics left by the old Mohawk Indians, that I trust it may not be without interest to the readers of this magazine if I describe a few of the things picked up, from time to time, upon their old village sites. The relics of all peoples are interesting as illustrating the manner in which they have groped their way up from lower depths of savagism, and valuable for comparison with objects of similar types from other parts of the world.

The similarity that exists among the relics of all Stone Age peoples is a fact that becomes apparent at once to an observer. It is interesting and surprising, and shows that they have all traveled the same hard road, and out of their necessities have wrought out many similar inventions.

The traveler of to-day, as he passes through the beautiful Mohawk valley, has little to remind him of the former savage owners of the soil, who, long before the advent of the Whites,

built their fortified towns on commanding hills, and paddled their elm-bark canoes on the river that bears their name. The insane love of war and conquest that possessed them, their cruelty and ferocity, for long ages made a very pandemonium of the valley that is now so peaceful and prosperous. At the head of the Five Nations, their name indeed "lead all the rest." They kept back the advancing Dutch and English; they were an almost impassable barrier to all French colonizing and proselyting among the cognate tribes in Canada, and red and white together, from Illinois to Acadia, trembled and fled at the cry of "a Mohawk! a Mohawk!"

The Five Nations, or Iroquois, called themselves the Konoshioni, or People of the Long House. The Mohawk valley was the eastern door, and the Mohawk tribe held it. While much has been written, from the time of DeWitt Clinton to the present, about the antiquities of the other tribes of the Confederacy, very little has been said or is known about the relics of the Mohawks. All that are described and illustrated in this article have been found on what are presumably sites of old Mohawk villages. These sites naturally divide themselves into two classes; the first, those unmistakably occupied during the Stone Age proper, where are found only relics of stone, and clay, and bone; and second, sites where relics of a mixed character appear, consisting of similar relics to those of the first period in connection with articles introduced by the whites after the discovery.

Village sites that can be certainly identified as belonging to the time previous to the introduction of metals are few; a diligent and careful search may discover more than are now known, but at present I know of but two. The first of these was evidently a place where the rough material was quarried and stone implements manufactured, as there are innumerable flakes and flint chips, broken and unfinished weapons and tools, and many arrow heads, etc., scattered over a surface of several hundred acres in extent. The other site is one of peculiar interest; as it has never been cultivated, and is covered with a pine forest, everything is undisturbed and is just as it was when it was deserted by the savages. It is a very Kjökken-Möding, where heaps of the refuse lie untouched. Here in piles of ashes and clam shells are found innumerable fragments of pottery, broken bones of animals, stone and bone implements, deers' horns, bears' and beavers'

teeth, and many other evidences of savage life. It is upon a point of land where two ravines meet, was evidently palisaded, and must have been an impregnable fortress when the only weapons were bows and arrows.

The labor that was required to surround such an extensive village must have been immense, especially when we remember that only axes of stone were used, similar to Fig. 1. These "celts" or hand axes are found the world over; this one is of a compact hard kind of green stone, has a fine cutting edge and is polished over its entire surface. These axes are called "thunderbolts" by the common people of many widely separated nations. Mr. John Evans, in his great work on the "Ancient Stone Implements of Great Britain," gives much interesting and curious lore in regard to this and similar superstitions. I have heard the same name applied to these ancient tools here in the Mohawk valley. Very poor tools we should call them, but in the hands of a savage proved wonderfully effective for cutting down trees and hollowing out canoes when used in connection with fire.

FIG. 1.—Celt.

In Fig. 2 is presented a side and front view of a stone carving carefully and skillfully cut out of a hard black stone; it seems to have been worn as an ornament or a charm, grooves being cut round it; as a specimen of the carving of a people having no iron tools it is certainly remarkable. The Mohawks were divided into three clans, the turtle, the wolf and the bear, and possibly the Indian who owned this may have been of the bear genus, and this may have been his "totem."

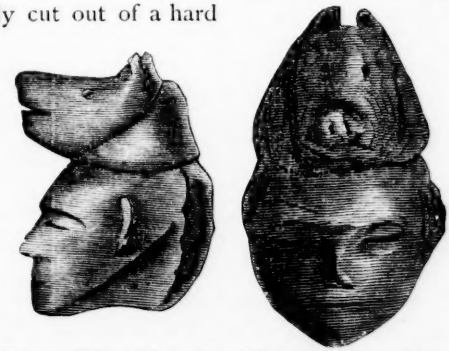


FIG. 2.—Side and front view of Totem—Indian and Bear. (full size.)

Upon the site previously referred to, fragments of pottery similar to Figs. 3 to 7 are found. It is unglazed and very hard, and seems to be made of clay and pounded shell or stone. The jars were of all sizes, round on the bottom, but made with a rim so that they could be suspended with a cord or strip of bark. The decoration consists of an exceedingly diverse arrangement of incised lines and dots, and it would appear from the similarity of the shape and ornamentation that there were regular

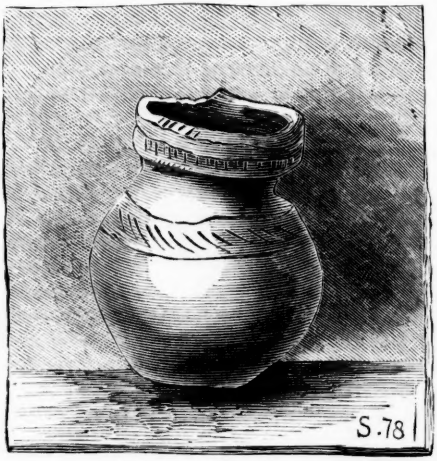


FIG. 3.—Mohawk Jar.

FIG. 4.

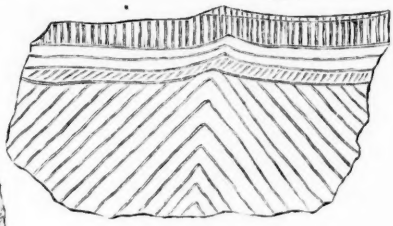
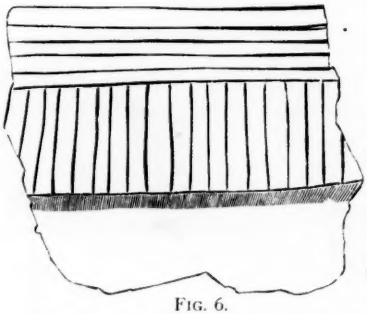


FIG. 5.



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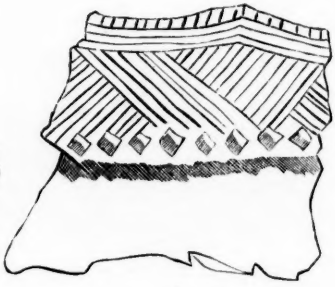

FIG. 7.

potters who manufactured all that were used by the village, and they seem to have had considerable skill in the plastic art, for not only is the pottery very creditable, but they also worked clay into other forms, showing great ingenuity in makings pipes, the bowls of which are frequently in the form of a bird or mammal, and these always being very true to nature. Some of these are shown in the engravings which fail, however, to give the spirit of the

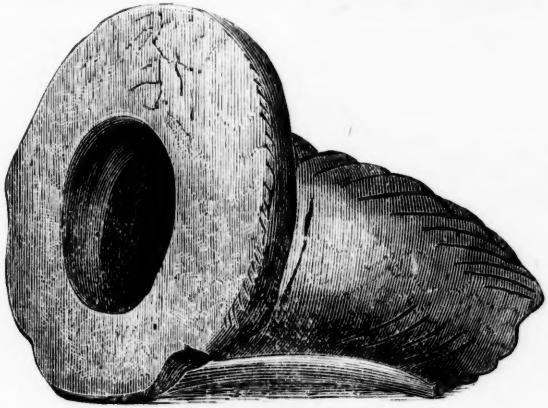

FIG. 8.—Fragment of Pottery Pipe.

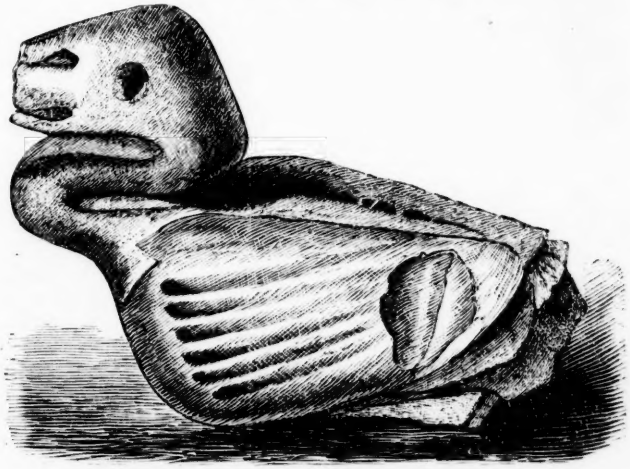

FIG. 9.—Fragment of Pottery Pipe.

originals. Fig. 9 is the fragment of a pipe and Fig. 10 and 11 are

samples of birds and animals, rude in style to be sure, but by no means inferior to similar terra-cottas from Mycenæ and Cyprus.

Among Aboriginal relics, bone implements are much more rare than those of stone, for

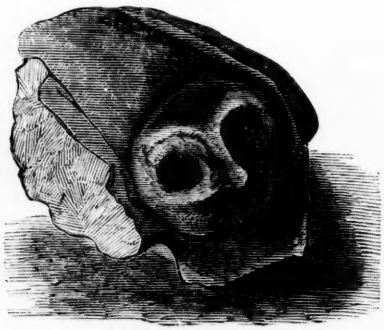

FIG. 10.—Owl.

FIG. 11.—Fox.

when exposed to the weather they are soon destroyed, and the sites of villages that are uncleared and uncultivated, and where these bone tools alone are found, are very few. Those that are found here, of which Figs. 14, 15 and 16 are samples, are for the most part awls or piercing implements, and are well made and highly polished; they have been worked out of hard compact bones, and scraped down with great labor. Among the many broken bones that are found, are some which show the grooves made by the stone saws in cutting out these tools.

FIG. 12.—Bear's Tooth.

FIG. 13—Beaver's Tooth.

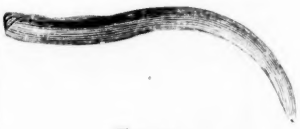

FIG. 14.

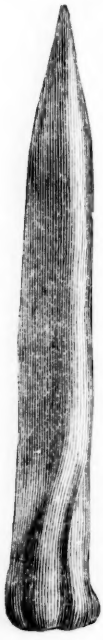

FIG. 15.

The bones of animals, like those in similar situations in other countries, are all split and broken to extract the marrow, and the teeth and jaws of bears, and deer, and beaver are as well preserved as though buried yesterday. Many necklace bones like Fig. 17, are found which show a great deal of laborious scraping.

FIG. 17.—Necklace bone.

FIG. 20.

FIG. 16.

FIG. 18.

FIG. 19.

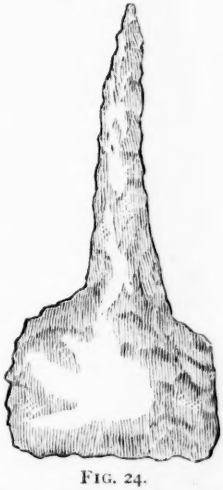

FIG. 24.

Necklaces of this kind were made by some of the tribes of the finger bones of their enemies, the squaws usually commencing the torture of a prisoner by sawing off the forefingers with a clam shell.

Upon all the village sites, upon the surface of the fields, and in the graves, the usual forms of stone implements are found, those

that are rough and chipped predominating largely over those that are ground and polished. Indeed one is greatly impressed with the remarkable similarity that exists between these rough stone implements and the palæolithic flints from the caves and gravel beds of Europe, and it would seem to be no difficult task to duplicate in a great measure from the surface finds, the engravings of these implements as given in the European archæological works on the subject. Many of those found here resemble the cave and gravel implements much more closely than any shown in this article.

Arrow heads are of many forms, and are made of various kinds

FIG. 21.

FIG. 23.

FIG. 25.

FIG. 27.

FIG. 22.

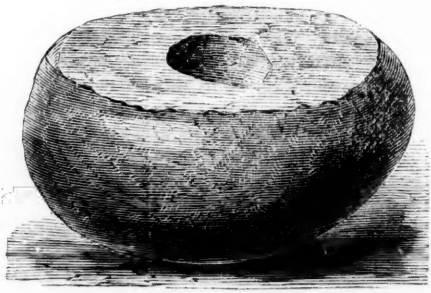

FIG. 26.—Hammer Stone.

of hornstone, and slate, and spar. Some of them are exceedingly rough, while others are flaked with great skill and are beautiful specimens of workmanship. All the forms of flint

implements such as knives, scrapers, borers, drills and others of unknown or not obvious uses, are abundant. Figs. 28 to 30 show a few of these latter forms.

The foregoing are specimens of what the Mohawks used during their Stone Age, but relics are abundant that were brought in at a very early day by the whites. Such are beads of various kinds, pipes and nondescript fragments of cop-

FIG. 29.

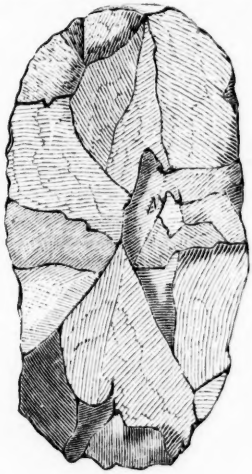

FIG. 28.

FIG. 30.

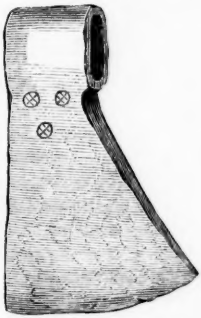

FIG. 31.—Trade Axe.

per, iron and lead, notable among which are the axes, Fig. 31, which although rude and clumsy in the extreme, were yet a great acquisition to men who had for generations, with infinite labor, wrought axes out of the flinty rock. These trade axes probably began to supersede those of stone previous to the year 1600, for Champlain in his expedition against the Mohawks in 1609 speaks of them as cutting down trees "with villainous axes of stone, and also of iron, which latter they had captured from their enemies;" their enemies were either the Indians of Canada, who obtained iron from the French as early as 1535, or of those southern tribes with whom the Mohawks were always at war.

In conclusion, I feel how impossible it is to do justice to this subject in so small a space. The extent of it can be imagined from the fact that the few forms here shown are from a collection of several thousand specimens. It is sufficient, however, to throw some light upon the manner of life and the progress of a people who filled so conspicuous a place in history at a time when European nations were struggling to gain a foothold in this western wilderness.

WALKS ROUND SAN FRANCISCO.

BY W. N. LOCKINGTON.

No. III—LAKE HONDA AND SEAL ROCK.

Ancylus fragilis, the so-called fresh-water limpet, is on record in Cooper's list of the Californian mollusca from Laguna Honda, or Deep Lake, as the name, being translated, implies.

Now Laguna Honda, a pond at the bottom of a deep valley about three miles south of the Golden Gate, has been captured by the Spring Valley Water Co., and converted, by upright retaining walls, and dams, and flood-gates, into a reservoir some thirty feet deep.

It is therefore pretty clear that the Ancyli in Laguna Honda are not easy to collect, but with the object of searching for the species in a lower lake which receives its overflow, my son and I start off for the locality one windy summer morning. Our road from the cars lies across Golden Gate park, the public park of San Francisco, a long narrow strip of land commencing some distance from the city and running straight out westward to the ocean beach. The greater portion is as yet park by courtesy, as the strip of land is principally drifting sand. A small portion at the city end is laid out, and drives are made through the whole length, but nineteen-twentieths of the area either lies at the west wind's will, or is covered with a growth of the large yellow lupine (*Lupinus arboreus*) and the blue wooly-leaved lupine (*L. chamissonis vel albifrons*). As the city has chosen a site without soil for its park, it is bound to try to make its own soil, and these lupines, hardy natives of the sand, have been selected as aids in the work. They prove very efficient, but the annual appropriation for park expenses is so small, and the west wind so constant, that he would be a bold man who would prophesy that the lupines shall be victorious for a generation or two. Between the park and the valley where lies Laguna Honda, is a high hill called Sweeney's Peak, from whose summit is obtained an extensive view over the peninsula and the bay.

There is little to detain us in the ravine by which we ascend, as the season is too advanced for many flowers, but the snow-ball bush (*Symphoricarpus racemosus*) displays its white bunches of fruit in the hollows, the red-flowered *Allium acuminatum* grows

on the hill-side, and the little song-sparrows flit before us from stone to stone as we advance upwards.

While standing on a spur near the summit, gazing on the panorama of the city and its surroundings, my son, who is bent on exploring, suddenly shouts from behind a large rock, "Papa, here's a fern!" And sure enough, in that dried out spot, in the crevices of a rock five hundred feet above the sea, far from all moisture, grow numerous examples of a thick-leaved simply pinnate fern. We secure some of the plants, and on enquiring from our botanical friends, find that the curious fern is known as *Polypodium scouleri.*

It is a rough descent over the sun-baked soil and slippery bents of grass from Sweeney's Peak to the Laguna, which nestles in the deep valley between it and the opposite peak.

Castilleia parviflora and *Convolvulus occidentalis* are almost the only flowers we find on our way down, and as the water in the lake is too low and too free from vegetation to give us a chance to collect Ancylus, we direct our course along the flume to the lower lake, passing through a dense thicket of *Silybum marianum*, or blessed thistle, a plant which, since its probable introduction by the Spaniards, has increased to the dimensions of a nuisance.

At last, on the stems of *Sium latifolium* we find a few Ancyli, tiny little vesicles of shells, which would certainly be overlooked by any one not specially searching for them, since they are only about a third of an inch long, almost colorless, applied to the stem by the whole of their under surface, and very much flatter above than their namesakes of the ocean beach. These "fresh-water limpets," it may be as well to remark, are but distant relatives of the real limpets, they are "Pulmonata, "or air breathers, like the fresh-water snails and the land snails, while the limpets are provided with gills like other univalves of the ocean. This is one of those cases, so many of which occur in the animal kingdom, where considerable outward resemblance masks radical structural differences.

As this is a rambling paper, and the last that we shall piece together from our rambles on this wind-stricken peninsula, we will lengthen out our walk northwards until we reach the Seal Rock road, along or near which we will trudge till we descend to the ocean beach close to the extensively-advertised Seal Rock. Seal Rock is one of the greatest lions of San Francisco, or

rather, it is the home of San Francisco's lions, those sleek and well-fed sea lions, which are protected from slaughter by special legislation, that they may, in conjunction with wasteful human fishers, destroy the "harvest of the waters." The rock is within easy rifle-shot of the terrace of the Cliff House hotel, yet it is crowded with sea-lions taking their ease in all kinds of positions, evidently fully aware that they will not be harmed. Most of the colony are dozing in the sun, occasionally opening their eyes, raising their heads, and perhaps uttering their characteristic howl; but some more active, are swimming among the breakers, their heads alone visible above the water. "I cannot understand how those things can bear such a life," remarked a well-dressed woman near me, with a look of disgust. And this when the creatures were basking in the sun and playing in the water with the most evident enjoyment—perhaps they were thinking the same of us—who can tell?

The long stretch of sandy beach between Seal Rock and the Ocean House does not present us with many forms of marine life that do not also occur in the Bay of San Francisco. *Cardium corbis* and *Macoma nasuta* are common, and so is the pretty little light-reddish bivalve *Mœra salmonea*. At intervals you may pick up the test of a very thin and flat cake-urchin, *Echinarachnius excentricus* A. Ag., looking like a large wafer; its height from crown to mouth so small that you almost wonder where the creature lived, and how it could ever move its heavy covering.

On the sand banks that form the bar at the entrance of the harbor, at a depth of six or seven fathoms, this sea-urchin can be procured alive; its test is then covered with a thick array of small spines, so closely set that when the creature retracts its suckers it is difficult to make out the "petals" or curved outlines of the ambulacral pores through which the suckers protruded. The name "*excentricus*" is very appropriate. The system of calcareous plates forming the crown (apical system) and containing the genital and ocular plates with their pores, is not in the centre as it is in the allied *E. mirabilis*, but is approximated to the anterior extremity of the test; neither is the mouth in the center of the underside. Two other species of sea-urchins, or Echini, glorying in the names of *Strongylocentrotus franciscanus* and *S. purpuratus* occur along the ocean beach at points not very far distant from San Francisco, but are not found in its immediate

neighborhood. The first of these attains a large size, the test or shell, denuded of its long spines, measuring five inches or more in diameter; the second has short spines, and is about two inches across. These are "regular sea-urchins," that is to say, they belong to that sub-order of the Echini which has circular, high, sometimes almost globular tests, with the five ambulacral areas at equal distances and of equal dimensions, pierced with rows of pores continuous from the mouth below to the apical system above, which latter contains not only the "ocular" and "genital" plates, but also the posterior termination of the digestive canal. The cake-urchin before mentioned, like all its near relatives, has the anus on the under side, thus departing farther from the "radiate" type, and the rows of ambulacral pores for the exit of the suckers are confined to the upper side of the test.

Along the upper portion of the sandy beach, at points where there are no cliffs but where the land meets the sea in rolling ridges of sand, may be found several plants which do not occur in other situations. Among these are *Frinseria chamissonis* and *F. bipinnatifida*, two compositæ with inconspicuous flowers and hispid fruits, covering large areas with their trailing stems and glaucous foliage; *Abronia cycloptera*, a relative of the garden flower commonly called four-o'clock, with its upright bunches of sweet-scented reddish flowers; *Heliotropium curassavicum*, one of the *Boraginaceæ*, with curled-up spikes of small white flowers, and thick leaves, and the yellow-flowered *Ænothera cheiranthifolia*.

On the cliffs near by, *Sedum spathulifolium* makes a show with its bunches of yellow flowers, mingled, perhaps, where the soil is deeper, with *Aster chamissonis* and the golden-rod, *Solidago californicum*. Here is a large area of cliff face covered with the long trailing stems of *Mesembryanthemum dimidiatum*, the three sided oblong leaves glistening in the sun, and the large deep-purple flowers glowing at intervals like rubies. It is the monarch of the sea-side flowers, and is worthy of a place in the flower-garden, but must not be planted in too rich soil, or it will run to stems and leaves, and forget to bloom.

On the hill-sides the most conspicuous plant is the "bladder-weed," *Astragalus menziesii*, not in bloom now save a few belated blossoms, but hung all over with the bladder-like pods from which its vernacular title is derived. The seeds in the ripe pods

rattle in the wind and the name of "rattle-weed" has thus arisen. A third name is the Spanish title of "loco" or "mad" plant, from the effects of its poisonous foliage upon the hungry cattle which are occasionally tempted by its green foliage and succulent stems—green and succulent when all around is brown and scorched, when even the "burrs" of the burr-clover (*Medicago denticulata*) are scarce and baked to chips, and the bents of grass are broken down into chaff—to feast upon what in times of greater plenty they avoid.

Although, broadly speaking, there are no trees on the peninsula of San Francisco, except the thickets of scrub oak (*Quercus agrifolia*) which clothe some of the more sheltered hills and valleys, yet the ravines of the few permanent springs display a crop of willows, mingled with a few examples of *Myrica californica*; and cliffs with a northern aspect are in some spots made beautiful by an abundant growth of *Heteromeles arbutifolia*, a showy rosaceous shrub, with red berries like the European hawthorn, but no thorns. Earlier in the season it blooms into a mass of showy bunches.

Ceanothus thyrsiflorus, a few starvling plants of which may be found among or near the willows, is, in more favored localities, one of the loveliest of shrubs, or rather trees, for it grows to the size of an apple tree. Covered all over with lilac-like bunches of odoriferous blue flowers (whence its local name of "blue myrtle"), and growing in extensive thickets over terraces and uplands, it is a living contradiction of the theories of color purists who deny that blue flowers and green leaves can be beautiful.

If we pick our way through the sand and over the hard-baked bed of what in winter is a watercourse, to one of the little coves which lie between the cliffs, we shall probably find numerous specimens of the curious little crustacean, *Hippa analoga* Stimpson. This little fellow lives in the sand between tide-marks, and although in the vernacular confounded with the species of *Orchestia* and *Allorchestes*, under the general term of "sand hopper," really belongs to a very different and higher division of the class Crustacea than that which includes his companions of the sand. He, or rather she, for the female is much the larger, has the body longer than wide, a narrow abdomen tucked under the body like that of an ordinary crab, five pairs of limbs, eyes

borne on stalks, and very conspicuous antennæ and mouth appendages. Thus he belongs to the *Decapoda* or ten-footed crustacea, while the other sand-hoppers, with seven pairs of limbs and sessile eyes, are in a lower sub-class. His great forte appears to be digging in the sand, which he does backwards, and with astonishing rapidity, disappearing in an attitude similar to that of a diving duck. Securing a few of these lively fellows, we return up the watercourse and across the sandy prairie to the road, gathering, as we proceed, a few flowering stalks of the yellow *Bahia lanata* and a twig of *Croton procumbens*, with its light green berries.

I think it is about time that the notion that a species must necessarily be named after some peculiarity that it possesses, should pass into the limbo of exploded ideas. There are now so many species of animals known, that it is, in many cases, impossible to define the differences between those which are nearly related in one word—it needs at least five lines of writing to do it. Two species differing in twenty particulars, no one of them, perhaps, very important, cannot be correctly distinguished by incorporating one of these points of difference in a specific name, and it frequently happens that a name which correctly describes one species will apply equally well to another species which has other peculiarities rendering it totally different. Thus *Sebastes ruber*, the red rock cod, is red enough, but there are two or three other red species of the same genus in our waters; and among the shrimps of the genus *Hippolyte*, *H. brevirostris*, although it has a short rostrum, is excelled in that particular by other species. As species are distinguished from each other not by one but by several peculiarities, it sometimes happens that the very character which, from its conspicuousness, has been incorporated into the specific name, may be wanting in an individual which yet belongs to the species; thus *Asterias ochracea*, the ochreous star-fish (our common species), is quite as frequently deep purple as yellow, and *Astacus nigrescens*, the blackish crayfish, is usually of quite a light tint.

The great necessity of zoölogical and botanical nomenclature is not so much to have a descriptive name for every species as to have one fixed, indisputable name by which each shall be universally known. This is an end difficult to reach, but will, at least in the majority of cases, be at length attained. Isolated workers in different countries, or distant parts of the same country, not

having access to the results of each other's labors, have separately described the same species, and have each given it a name. Perhaps one has called it *obesus* because it was short and thick, another, *sanguineus* because it was red, a third, *macrodactylus* because it had a large toe, while a fourth has named it *smithii* after his friend, John Smith.

But it is now a recognized rule among naturalists, and it is a rule that ought to be rigidly enforced, that priority of publication shall give precedence, and as soon as it can be ascertained which of the names was first given, provided it was accompanied by a description, that name shall in future be the name, no matter whether it is good or bad Latin, or even whether it is rightly or wrongly spelled. It is the baptismal name, and, like that of an infant, must ever remain its name. It is only by keeping to this rule that we can ever reach bottom in scientific nomenclature; if every aggressive genius were allowed to change a well-known name for one that, in his estimation, fits it better, and if every Latinist, ignoring every consideration but those belonging to his pet grammar, might alter terminations and orthography at his will, the synonymy of species would be endless. The same rules apply to specific names that apply to the surnames or cognomens of human beings.

When men were fewer, and proper names like John and William were the only recognized ones, the various Johns and Williams were distinguished from each other as John the baker, John the butcher, etc., or personal peculiarities were made a note of, and William Tallboy and John Short, with other sometimes very curious names arose; or a man leaving his native town of, let us say, Lincoln, became known in his new residence as John of Lincoln. These names stuck to the families, the members of which changing their trades, or possessing different physical peculiarities, often become the antipodes of their names. Thus, John Baker may be an iron monger, John Short may be tall, William Armstrong may be no stronger in the arm than John Smith, and John Gross may be a Lilliputian. I must now beg pardon of our esteemed corresponding secretary of the California Academy of Sciences, because I have taken the liberty to append his name to a species of fish which I believe has hitherto not been described. Many other names would fit it; it is long, slender and round, so are all the tribe it belongs to; it is brown, so

are others that are nearly related; it has two rows of teeth on each side of the mouth, so have all its family; there are ten teeth in the front row and nine in the back; this is characteristic, but it would puzzle the best Latinist to put it in one word; and it has eleven gill openings, and this might be expressed by a compound Latin name which would be awkwardly long, and after all would not mean with eleven gill openings, but simply with eleven openings, so that on the whole I prefer *stoutii;* and stoutii, with the doctor's permission, it must be, unless some one has anticipated me in describing the fish.

Bdellostoma stoutii nov. sp. Eleven gill openings on each side; ten teeth in the anterior and nine in the posterior series. 15½" long. Eel river, Humboldt county.

It is rather singular that this fish, which is abundant in Eel river, and is sold for food, and also occurs in this harbor, should hitherto have escaped notice. I believe it to be the only species of its genus hitherto found on the Pacific coast of North America; and it differs from *Bdellostoma polytrema*, a species which occurs along the coast of Chili, both in the number of its gill-openings and that of the teeth, *B. polytrema* having fourteen of the former and twelve of the latter in each series.

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THE BENEFICIAL INFLUENCE OF PLANTS.

BY J. M. ANDERS, M.D., PH.D.

A GOOD deal of attention has recently been given to the subject of the sanitary relations of plant life. Since plants constitute so great a factor in the organic world, a study of their functions necessarily becomes interesting and important. As every one knows, the knowledge of these processes is being rapidly unfolded, and clearly, the way to render this most useful is to examine into their practical relations; for our appreciation of plants and flowers must, to a great extent, go hand in hand with the increase in knowledge concerning their influence on our health and welfare. As our information in this direction increases we shall be more ready to acknowledge how much we owe to vegetation; still it is to be hoped that our ideas will never revert to the extravagant theories of the ancients, for we find that mythology credits trees with marvelous powers, such as their

being the abode of spirits, some of which were held sacred while others were supposed to be demonic. Trees were also supposed to be sentient beings and even possessed of souls. Strange as it may seem in this age of enlightenment, some relics of these ancient superstitions still linger in certain quarters of the globe.

Prof. Pettenkofer[1] has lately discussed the question of the hygienic relations of plants from a new standpoint, and has doubtless thrown new light upon it. He has, to his own satisfaction, demonstrated that three of the great functions in plants, namely, the giving off of oxygen, the absorption of carbonic acid and generation of ozone, really have no hygienic value whatever. The proof of his argument rests largely upon the solid basis of experimental researches conducted by himself and other noted investigators. It is but fair to say, however, that Prof. Pettenkofer does not deny *all* hygienic influence of vegetation, but attributes its influence to other circumstances rather than to the variation in the amount of the gases; and yet, in setting forth what he believes to be the sanitary operations of plants, he omits making any allusion to the process of transpiration as affecting the sanitary conditions of the air. This is not so surprising when we reflect how very imperfect our knowledge of this function has been up to a very recent date. In a paper on this subject we have presumed to attach more importance to this function.

We shall now make the proposition—a deduction from actual experiment—that the hygienic conditions of the air are both directly and indirectly affected by plant transpiration. It will be seen that the statement ventured contains two distinct elements, one implying the direct effect of transpiration on the air, the other the indirect; and it has been deemed best to discuss these elements separately in order to render the subject easier of comprehension.

The direct effect of transpiration might be formulated thus: In all atmospheres in which the proportion of aqueous vapor is less than the healthiest standard (about seven-eighths of what the air can contain at a given temperature), the beneficial influence of transpiration must be in proportion to the amount of aqueous vapor exhaled. In this connection the question naturally arises, What is the rate at which watery vapor is given off from plants? Here it will, perhaps, be pardonable to refer to the author's pre-

[1] Popular Science Monthly for February, 1878.

viously published experiments[1]; and, in order to establish this rate an extract from the summary of these investigations will be introduced, since they were instituted with the object of establishing the rate of transpiration:

In clear weather the evaporation by night, as compared to that which takes place in the day, appears to be about in the ratio of one to five. In some cases no loss occurred on dewy or cloudy nights. The camellia, however, lost nothing during clear nights, and gained in weight on dewy or rainy nights, even when kept indoors. Under ordinary circumstances evaporation at night was about the same indoors as in the open air.

The rate of transpiration during the day showed a very different relation, giving a ratio of two to one in favor of the open air. Of the whole amount evaporated during twelve hours, in the day experiments, half was given off between the hours of 11 A. M. and 3 P. M., as shown by repeated testing.

The following table, compiled for the number of clear days, will serve to exhibit the average rate of transpiration by day which took place in the open air during clear weather. It will also indicate the relation between leaf surface and the weight of the plant, and amount transpired. The mean temperature and average dew point have also been recorded in the table:

No.	Name of Plant.	Duration of Experiment	Average Evaporation.	Evaporating Surface.	Weight of Plant.	Average Temp.	Aver'e dew pt
1	Calla	12 hours	2850 grains	All parts green	2 lbs. 2 oz.	. .	. . .
2	Geranium	"	3500 "	. . . . .	44201 grains	. .	. . .
3	Fuchsia	"	1975 "	450 square in's	1920 "	64.5°	49.6°
4	Hydrangea	"	2858 "	744 "	2170 "	73	56.7
5	Camellia	"	710 "	479 "	. . . . .	75.5	63.3
6	Lantana	"	1717½ "	330 "	720 grains	75.1	61.7
7	Dracæna	"	2422 "	817 "	. . . . .	75.5	62

After an inspection of this table, the average rate of evaporation for soft thin-leaved plants, in clear weather, may be put down at about one and a quarter ounces per day (twelve hours) for every square foot of surface. The Lantana shows nearly two ounces to the square foot of surface. The camellia, with its dense smooth leaves, averaged less than half an ounce to the square foot of surface, per day.

* * * * * * A few calculations may serve to impress the importance of the ratio of transpiration deduced from these experiments. According to the above rate the Washington elm, at Cambridge, a tree, it is stated, of no very large size, with its 200,000 square feet of leaf surface, would transpire seven and three-quarters tons of watery vapor in twelve hours (day), clear weather.

Carrying the calculation further, a grove consisting of five hundred trees, each with a leaf surface equal to that of the elm mentioned, would return to the atmosphere 3906 tons of aqueous

[1] Compare this with journal for March, 1878, p. 160.

vapor in twelve hours. Even supposing this to be much over-estimated, it may very fairly be concluded from the facts given that the evaporation of watery vapor from plants is a powerful agent in maintaining the humidity of the surrounding air.

Some scientific critic might claim, as an objection to the latter assertion, that the amount of vapor exhaled from plants, though in itself large, is inconsiderable when compared with the evaporation from the surface of the earth. This seeming objection may, perhaps, best be confronted by a few calculations, and we first inquire what is the relative vaporization from a given area of leaf surface, and an equal area of earth surface? Taking the average rate of transpiration for soft, thin-leaved plants in clear weather to be one and a quarter ounces per square foot, and multiplying this by the number of days in a year the product would be twenty-seven pounds, or an equal number of pints. Now by reducing twenty-seven pints to cubic inches and dividing the result by the number of square inches in a square foot (144) we must obtain the depth in inches of the water transpired in the course of a year, about five and two-fifths inches. To continue our reckoning, we will next attempt to show the mathematical relation between the extent of the leaf surface of a section of country and the surface of the earth of the same section. According to the census returns for 1875, the percentage of woodland of the entire area of the United States, including Territories, water surfaces, cities, highways, etc., is 25; that is to say one-fourth of the total area is woodland. Now if we suppose every 900 square feet of forest land to contain one tree, and estimate each tree to be one-thirteenth the size (only) of the Washington elm, at Cambridge, we shall have about one-third of an acre of leaf surface for every tree; then it will not require much mathematical skill to understand that by multiplying the supposed leaf surface of each tree (one-third acre) by the number of trees per acre, and this in turn by the fraction one-fourth, or the proportion of woodland in the United States, the product will be four to one in favor of leaf surface over the total area of land surface. We have seen that according to our calculations the depth of transpiration per year for soft, thin-leaved plants is about five and two-fifths inches, but this must be an over-estimate, for the plants are actively giving off watery vapor only about five months of the year, that is, out of doors. We shall, therefore, suppose five-twelfths of five and two-fifths inches

or about two and one-fourth inches to be the yearly depth. Now if all the water transpired from this leaf surface were given off from a surface equal to that of the land area, we should find on a little reckoning that the depth of transpiration would be nine inches. It is to be remarked that transpiration from the grasses, cereals, underbrush, etc., was not considered in these calculations, but there can be no doubt as to their great assistance in this process; so that, were it possible to form anything like a correct estimate of the amount exhaled by these humble specimens of the vegetable kingdom the ratio would be greatly increased.

In our Southern States, many of which have as high as fifty per cent. of woodland, the depth for plant exhalation must be much greater, equivalent to at least eighteen inches, since the conditions are so much more favorable. All will agree that this is no mean showing for transpiration as affecting the proportion of moisture in the atmosphere, the yearly average rainfall being forty-three inches at Philadelphia.

There are evidently many inaccuracies in a computation like the foregoing, which it is exceedingly hard to avoid, but the allowances made will, it is hoped, meet the discrepancies and thus the true mark will not have been overreached.

Provided our reasoning be at all correct, the objection of our philosophic critic cannot have any weight, and the important fact remains established, that *transpiration is capable of increasing the humidity of the air.* Now, if transpiration so materially affects the quantity of the moisture in the outer air, what must be the effect of keeping plants in closed apartments? This question will here be discussed, and especially the effect of plants on the air of rooms heated by hot-air furnaces. According to the above extract it will be seen that the process is only about half as active indoors as in the open air, during the day, but at night the rate of transpiration is about equal in the two situations, so that during the whole twenty-four hours the quantity a plant would transpire indoors exceeds half what it would transpire in the open air, and we may presume from this fact alone that plants in rooms would influence the relative humidity of the air of the rooms.

From observations which I have made over a period of several weeks on the air of my private reading and sleeping room at the Episcopal Hospital (Philadelphia), which is kept warm by air heated by steam, and simultaneously on the air outside, it was

found that the air in the former position was appreciably dryer than the latter, the average complement of the dew point being on the whole about five degrees greater. The room adjoining mine, occupied by my colleague, was very kindly left for a time at my disposal; in it were kept a few plants in pots with a leaf surface of not more than twelve square feet. The dimensions of the rooms were similar, each being twenty feet long, eleven feet wide and sixteen feet high. Each had one window fronting east, in which the plants were kept. The average temperature and dew point in both these rooms were noted simultaneously, and the results showed uniformly, for a period of eighteen days, that the complement of the dew point averaged one and a half degrees less in the room containing the plants. These observations were made during the early part of April, 1878, when very little heat was required, still the windows were kept closed during the day. Calculating from these results, the effect of twenty-four square feet of leaf surface on the air of a room half the size of the above would be to increase the humidity sufficiently to raise the dew point six degrees Fahrenheit higher than it would be if there were no plants in the room. There can be no doubt but that a southern exposure of the plants would make the difference even greater.

As it seemed possible that the variation in the amount of moisture in the two rooms tested might be due to considerations other than the presence of plants, it was deemed necessary to vary the conditions and make further observations. Accordingly after placing some plants in the window of my own room, I took the average temperature and dew point, and compared them with those of an adjoining room containing no plants. No artificial heat was required during the time of these experiments. It was found that when the window was kept open so as to cause very free ventilation, no appreciable difference in the humidity of the two rooms was observed; but if the windows were closed for a few (say three) hours, it would make a difference of from one and a half to two degrees Fahr. in the complement of the dew point; the room having plants showing the lesser complement. This difference was maintained, almost, when the windows were opened just enough to allow a gradual interchange of the contained air; but as before intimated, a draft, though it might hasten transpiration, would, by carrying off the

vapor, prevent an increase of moisture in the air of the room. On days when the air was laden with moisture, no difference in the dew point was noticed, there being at such times little or no exhalation of watery vapor. The observations taken at 1 o'clock P. M., gave the greatest variation, the morning observations usually the least. We do not wish to say dogmatically that there is no possible chance of error in these experiments, but since they were corroborative throughout it seems fair to conclude that they are correct. Since it is allowable always to make logical deductions from facts, we may justly conclude, from the statements made in the above extract concerning the rate of transpiration, coupled with the carefully conducted observations here detailed, that during the summer months when the windows are thrown widely open and the doors kept ajar, the influence of transpiration is quite inconsiderable; on the other hand, when the interchange of air is not too rapid a sufficient number of plants, well watered, have the effect (if the air be not already saturated) of increasing the amount of moisture to a considerable extent.

As before intimated, it is my wish to apply the results of these researches particularly to the atmosphere of apartments heated by means of hot-air furnaces, which are known to be dryer than air heated by a stove or open fire-place. Not having the opportunity myself at the Hospital of comparing the dryness of air thus heated with that of the outer air, my wants were made known to a friend residing in a house heated by a dry-air furnace. Through the kindness of this friend reliable observations were made for a period of eight days. The results showed the mean average complement of the dew point to be seven degrees Fahr. greater for the heated air than the air outside. Now, according to our line of reasoning, a certain number of plants would bring up the humidity to that of the external air. Calculating from the above data, half a dozen each with a leaf surface of four square feet would be sufficient to produce this effect in a room twelve feet long and ten feet wide with a ceiling twelve feet high. The mean average temperature and dew point for the out-door observations were fifty-six degrees and forty-one degrees Fahr. respectively, which is a percentage still considerably below the healthiest standard. Some one, not a professional medical man, might pertinently ask: What is the effect on the system of air heated by a hot-air furnace? It will be necessary to answer this

inquiry only so far as relates to the effect of dry air at the ordinary temperature of such rooms.

If an apartment is heated to sixty-five or sixty-eight degrees Fahr., a person in good health and in ordinary clothing feels comfortable and experiences no immediate inconvenience. But the air contains a much smaller proportion of vapor than if the air were warmed to the same degree by a stove or open fire-place. In this manner a great demand is made upon the system to supply the air with moisture, the skin and pulmonary mucous membrane are dried, and a condition is induced which is expressed in irritability of the nervous system, paleness and susceptibility of the skin to cold, liability to pulmonary diseases, and, in a word, deterioration of all the functions.[1]

Now, it will not be doubted by any one, that if, as we have attempted to point out, the presence of a certain number of thrifty plants in an occupied apartment, warmed by dry air, would have the effect of raising the proportion of aqueous vapor to the extent indicated, plants in rooms heated by a hot-air furnace would in a hygienic point of view, be of very decided value, since they may become the means of obviating very distressing symptoms, or even disease itself. Indeed, the circumstance of so large a portion of the population of cities and towns using the hot-air furnace as a means of heating their dwellings would seem to justify the conclusion that there is a connection between their bodily ills and this method of heating, that one might be traceable, in part, to the other. It is true there are good uses of dry heat for the relief of certain diseases, but it requires a judicious application—a knowledge of the conditions in which it is indicated; it should be employed only when prescribed by a regular physician. In his very able paper, Prof. Pettenkofer wisely considers the impression which plants (and plantations) make upon our mind and senses to be of hygienic value. And, furthermore, he says: "I consider flowers in a room, for all to whom they give pleasure, to be one of the enjoyments of life, like condiments in food." May we not now rightfully consider plants kept in rooms under proper regulations to be of sanitary value also on account of their influence over the proportion of vapor in the air? And of the two effects is the latter not worthy of being made the paramount consideration?[2]

[1] Stillé Therapeutics, Vol. i, pp. 637–8.

[2] The following letter was received from my estimable friend as an acknowledgment of my paper on the Transpiration of Plants, which appeared in the March

Before passing to the consideration of moisture in the air as a means of lessening terrestrial radiation, which we have designated as the indirect effect of transpiration, it seems appropriate to give a place to a few of the laws governing radiation in general.

Radiation has been defined by Tyndall as a vibratory movement which begins in the ultimate particles of matter, and is propagated through waves of ether.

Different bodies absorb heat and radiate the same in degrees varying with their molecular constitution; that is to say, some bodies disturb the ether to a greater extent than others. It is an all important and universal law, that the power of a body to absorb heat and its power to radiate heat are reciprocal. Heat rays are emitted from both luminous and non-luminous bodies. The theory now almost universally accepted is, that heat and light are similarly transmitted; a ray which will give rise to the sense of heat by falling on the surface of the body will, if it fall on the retina, produce the sense of light, in general terms. Though the ray itself is the same in both instances, it is called, in the one case, a calorific ray, and in the other a luminous ray, on account of the effect produced. The only advantage in retaining these terms is convenience in communication. Bodies which allow the rays of light to pass freely through them are said to be transparent, on the other hand, bodies which allow radiant heat to pass through them are said to be diathermic. It

number of this journal. The author of the letter not being aware, at the time of writing, that the present paper was in preparation.

J. M. ANDERS, M.D.

My Dear Dr:—I have read your "Transpiration of Plants" with much satisfaction. The amount of water exhaled is so greatly in excess of what I supposed to be the usual quantity, that it leads me to believe that the common opinion of physicians and laymen, that plants are injurious in the sick room, is wholly erroneous. I say the common opinion—I might say the universal opinion—for I have seldom, if ever, heard a favorable opinion of the practice expressed by any one; and yet I may not be well read in the literature of the subject, for, in your closing paragraph you say: "The practical advantage of keeping plants in occupied rooms, in which the air is generally drier than that outside, has also, from the results obtained, received further demonstration."

I am temped to ask you where you have ever seen the "advantage" of the practice spoken of? I speak now of plants in the sick room. Your paper has brought to me new thoughts, and carried me back over a practice of half a century to see what confirmation of the advantage of the practice I can bring forward. Physicians have often spoken to me against the habit of some people who have growing plants in the sitting room occupied by the family, and especially in rooms occupied by con-

is well known that the property of transmitting light is possessed by bodies in different degrees; their ability to transmit heat has been found to be equally diverse. Now the diathermancy of substances is greatly influenced by certain conditions, among which may be mentioned, more particularly, the nature of the molecules of the body, its thickness, and especially the source or kind of heat. The rays which are not transmissible through a body are absorbed by it, thus elevating the temperature of the body; when the body is perfectly diathermic, however, there is no elevation of temperature. Now, since the absorption and radiation of heat are reciprocal, it is interesting to know how the atomic constitution of the body is affected in these processes. The rays on striking a body are some of them absorbed and heat the atoms of the body, when each of these atoms acts as a heated body itself, and emits the rays absorbed, in all directions. It has been proved that absorption does not take place on the surface, but within the absorbing body, a certain thickness being necessary to effect the phenomenon.

As the substance with which we are most concerned is in the gaseous state—aqueous vapor in the air—we shall pass to the consideration of the radiation and absorption of gaseous substances. When we reflect that some solid and liquid bodies are almost or entirely diathermic, it would, at first sight, appear absurd to talk of gases absorbing and radiating heat. One would

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sumptive patients; but I have never heard any physician advise that plants should be placed in the sick chamber as a remedial measure. I hope your experiments will lead to a change of opinion on this subject—a change which you seem to anticipate—for if the exhalation really be so great, we have it in our power to regulate the amount of moisture in the sick room. Year after year new health resorts are urged on the public; abroad there are many; and in this country, from St. Augustine to Minneapolis, they are to be found in every State, the low, warm, moist places of the South, the cool mountain regions of the Middle States, and the cold, dry climate of Minnesota. Consumptives rush to every new place only to find, in a short time, that, like the others, it must be given up as useless. Science has no influence in the choice of places. Allow me to speak of a case which in this connection may interest you.

My mother, her two sisters and only brother all died of consumption under fifty years of age. On my father's side there was not a taint of any disease, but great strength and vigor. All the children of my mother's sisters and brother, though they lived to a good age and enjoyed good health, finally died of consumption. Three of my brothers, active, energetic men until within a few years of their death, died of consumption at the ages of 55, 57 and 78 respectively, and a sister died of the same disease at 66. I mention these cases to show that the germs of the disease were with the family. Thirty years ago my eldest sister, then above fifty years of age,

suppose from the circumstance that the spaces between the molecules are so much greater in the case of the gases than in solids or liquids, that no such thing as the interception of rays by these separate particles could occur. But recent, very ingenious and delicate experimentation by Prof. Jno. Tyndall has placed the fact beyond the domain of mere reasoning, that gases do intercept radiant heat, in other words, absorb and radiate calorific rays. It would be outside the limits of the present writing to describe the apparatus used and the methods pursued. Suffice it to allude to the results obtained by this investigator, and the conclusions arrived at by him. The correctness of these results will doubtless be readily conceded after a perusal of his admirable work on "Radiation," where everything is fully explained.

In experimenting with olefiant gas and sulphuric ether vapor, it was found that the densities of these two gases may be reduced vastly below that which corresponds to the atmospheric pressure, and still they were capable of arresting undulations of heat. On investigating some of the permanent gases, as carbon dioxide, nitrous oxide, etc., he found extreme variations in absorbent powers. The heat-absorbing capacity of hydrogen and of dry air were found to be inappreciably small, while carbon monoxide, carbon dioxide, etc., were found to be active absorbents. Considering the absorbing capacity of dry air one, that of carbon dioxide, would be ninety. Experiments with ozone place this

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was reported by her physician, Dr. J. P., a victim of tubercular consumption, to which disease she would succumb before the coming summer. She was a lover of plants and flowers, and cultivated them in-doors and out. The spring saw her again moving among her plants, and the winter found her confined to the house, and sometimes for weeks to her bed-chamber, which, like the sitting-room, was literally a green-house. Visitors and friends often spoke to her of the impropriety of having so many growing plants in her room, reminding her of the tradition that they were injurious. Still, every spring found her again on her feet, in the yard and garden, nursing her plants, and every winter confined to her room. And thus she lived, year after year, until two years ago when, at the age of 85, she passed away. I have seen a few others have plants growing and blooming in their chambers, but never one who so lived among them as did my sister. Winter after winter we looked for her death, the cough, expectoration and weakness justifying our apprehensions, and yet her 85th year found her cheerful and happy, living among her plants and enjoying the society of her friends. May we not believe that the vast exhalation from these plants—water purified and medicated by their vital chemistry—prolonged her life? The results of your experiments will awaken thought, and lead to observation on the influence of growing plants in the chambers of the sick. Truly your friend,

HIRAM CORSON.

substance in the foremost ranks as an interceptor of radiant caloric.

These researches by Prof. Tyndall were extended, also, to vapors of different bodies, such as sulphuric, boracic and formic ethers; and determined them to be highly active in interfering with calorific rays, boracic ether "exceeding any other substance hitherto tried." All the experiments above quoted are certainly of great scientific interest and importance; but happily this illustrious scientist did not omit to study the effect on radiation of the aqueous vapor constantly in our atmosphere. The quantity of vapor of water contained in the air is, however, very small indeed, constituting only about four and a half per cent., and, although the moisture is everywhere present, its ratio is very variable. It is perfectly invisible, so that by our senses we are quite unable to judge of the amount present; even the purest sky may contain a large proportion. As this vapor is to all intents and purposes a gaseous body, obeying the laws of gases, any one not familiar with the information which we have just outlined, would, doubtless, hesitate to accept the assertion that the watery vapor so sparsely scattered through the atmosphere is the main agent in regulating the nocturnal radiation from the earth's surface. Even Tyndall, himself, neglected for some time this substance; and, in his own phraseology, "could hardly credit the first result, which made the action of the aqueous vapor of the laboratory fifteen times that of the air in which it was diffused." But this result does not show the correct relation of the action of vapor and air; for after repeated experiments with air from different localities and examined similarly, the results were uniformly to the effect that vapor of water has an absorbing capacity seventy times that of the air in which it is contained. Many objections and criticisms, some of which seemed almost insurmountable, were overcome by varying the methods of procedure. The assertion made above, therefore, seems to have been fully and satisfactorily demonstrated by a most careful and competent experimentalist.

Still further testimony might be adduced, the result of observations of meteorologists. Col. Richard Strachey, an eminent meteorologist, made observations showing the relation between the tension of the aqueous vapor of the atmosphere and the fall of the thermometer during the night. A single statement taken

from his results will be sufficient for our purpose, namely: "When the tension of the vapor was 0.888 inches the fall of the thermometer was 6.0° Fahr., and when the tension was only 0.435 inches the fall amounted to 16.5° Fahr." It is fair to state that these observations were conducted long before Tyndall's researches with aqueous vapor, and are on this account all the more valuable. The evidence we have adduced seems to show conclusively, that the vapor forms a sort of invisible canopy separating the chilling air above from the warm earth beneath, and arresting, more or less effectually, the radiation. We have a homely illustration of this when we see the thrifty housewife spread coverings over the more delicate plants of her flower garden on nights when she fears a frost. It has been said that aqueous vapor is a blanket more necessary to the vegetable life of England than clothing is to man; and every plant capable of destruction by freezing would succumb, if this vapor were removed for a single night. In support of this assertion it will be well to notice the results obtained by some noted observers concerning the daily fluctuation in temperature in other countries. Dr. Livingston[1] has observed a great excess in nocturnal chilling when the air is dry over that which occurred when it is laden with moisture. He has found in the southern central portion of Africa, during the month of June, the thermometer early in the mornings at from 42° to 52° Fahr., at noon 94° to 96° Fahr., or a mean difference of forty-eight degrees between sunrise and mid-day. He says, furthermore: "The sensation of cold after the heat of the day was very keen. The Balonda at this season never leave their fires till nine or ten in the morning. As the cold was so great here, it was probably frosty at Linyanti; I therefore feared to expose my young trees there."[2] Crossing the continent, Dr. Livingston reaches the Zambezi at the commencement of the year. He gives the following description of the change felt on entering the valley of the river:

> We were struck by the fact that as soon as we came between the range of the hills which flank the Zambezi the rains felt warm. At sunrise the thermometer stood at from 82° to 86° Fahr.; at mid-day in the coolest shade, namely, in my little tent, under a shady tree, at 96° to 98° Fahr., and at sunset at 86° Fahr. This is different from anything we experienced in the interior.

[1] Livingston's Travels, p. 484.

[2] Livingston's Travels, p. 484.

Proceeding toward the mouth of the river (Jan. 16th), he makes the following additional observation:

The Zambezi is very broad here (at Zumbo) but contains many inhabited islands. On the 16th we slept opposite one called Shibanga. The nights are warm, the temperature never falling below 80°, it was 90° Fahr. even at sunset. One cannot cool the water by a wet towel round the vessel.[1]

Evidently the air was nearly saturated with moisture in the latter locality, and this affords the only explanation of the evenness of the temperature here.

In Australia the daily range of the thermometer is extremely great. The observations of Mr. W. S. Jevons[2] are of much interest, and we give an extract:

In the interior of the continent of Australia the fluctuations in temperature are immensely increased. The heat of the air, as described by Capt. Stewart, is fearful during summer; thus in about latitude 30° 50′ S., and longitude 141° 18′ E., he writes: "The thermometer every day rose to 112° or 116° in the shade, while in the direct rays of the sun from 140° to 150°." Again, "At a quarter past three, P. M., on January 21st (1845), the thermometer had risen to 131° in the shade and 154° in the direct rays of the sun. * * * In the winter the thermometer was observed as low as 24°, giving an extreme range of 107°" From these data we are not surprised to hear him remark further on, that, "The fluctuations of temperature were often very great and sudden, and were severely felt." He says, moreover, "It thus appears that even close to the ocean the mean daily range of the Australian climate is very considerable. It is least in the autumn and greatest during the cloudless days in spring." After giving here a table of the seasonal variation of the rainfall in Australia, Mr. Jevons says that, "It is plainly shown that the most rainy season of the year on the east coast is the autumn, that is, the three months, March, April, May. The spring season appears the driest, summer and winter being intermediate.

Prof. Tyndall says:[3]

Without quitting Europe we find places where, while the day temperature is very high, the hour before sunrise is intensely cold. I have often experienced this in the post-wagons of Germany; and I am informed that the Hungarian peasants, if exposed at night, take care, even in hot weather, to protect themselves by heavy cloaks against the nocturnal chill.

All this evidence should be sufficient to convince the most

[1] Livingston's Travels, p. 575.

[2] Quoted by Tyndall.

[3] Discourse on radiation through the Earth's Atmosphere.

skeptical that aqueous vapor furnishes a very effectual barrier to terrestrial radiation.

The tropical torrents can be accounted for by the property vapor has to absorb and radiate heat, thereby condensing the vapor raised from the equatorial regions through the direct rays of the sun. But it is only the upper strata of the vapor bed covering the surface of the earth, which by radiating into open space produces the effect above stated. Owing to the same quality may be explained the formation of cumuli; the theory of sereim, or the falling of the exceedingly fine rain shortly after sunset in the fine season. These and many other meteorological phenomena receive their solution from the development of this property of aqueous vapor. Every one will readily acknowledge that a question affecting so materially important sciences as the one under consideration, should be quite definitely settled, and it is for this reason that so much stress, by way of testimony, has been here placed upon it.

Admitting then that the vapor in the air does, by the property above discussed, influence numerous climatic conditions, the sources of this vapor certainly should claim a larger share of attention.

Nature's chief means of furnishing this moisture is through vaporization from the ocean, especially in the tropics; but many tracts of country inland, or even near the great seas, do not, for some reason, contain sufficient moisture. Now, if by any means at our command we can assist nature in supplying this very essential substance, it would be well worth our endeavors. Here the question presents itself, "Is there any connection, all things considered, between the proportion of moisture in the air and forest growth?" This question has been the subject of a great deal of discussion among able scientists, and we believe the balance of argument is in favor of the theory that there is a relationship existing between vegetation and the humidity of the air. The writer hopes he may have been successful in showing that a large proportion of the atmospheric vapor may be accounted for through the process of transpiration from plant life, that is, where there exists a fair percentage of woodland, say from twenty-five to thirty per cent.; so that now the above query may, we think, be answered in the affirmative. Under these circumstances the practice of forest culture as a means of improving atmospheric conditions, cannot be too highly commended.

MODES OF SPREADING AND MEANS OF EXTINGUISHING THE MAPLE-TREE BARK-LOUSE.

BY EMILY A. SMITH.

IN the October number of the AMERICAN NATURALIST I gave the life history of *Lecanium acericorticis* Fitch, and now conclude with the modes of spreading and the best artificial means of destroying the insect.

The disposition of the female to remain upon the same tree throughout its entire existence renders the modes of spreading from tree to tree incidental to outside influences. They are conveyed from one locality to another by the transportation of the trees while the females are upon the limbs, and are so nearly the color of the tree itself that without a magnifier are easily overlooked. The waxy mass exuded by the female in which she deposits her eggs, contains a sweet substance which is much sought after by various species of flies and wasps. When the young insect emerges from the egg, the tendency is to wander about for a time before settling upon the leaves, and the presence of the wasps and flies upon the tree in search of food at this time attracts the young lice and they attach themselves to their hairy legs and are thus conveyed to other trees. The wind and rain detach the egg-mass from the limb and convey it to other localities while the eggs are yet within.

The *L. acericorticis* are kept somewhat in subjection by the aid of the natural enemies and parasites found preying upon them; but when they increase beyond the power of these friends of ours to control them, artificial means must be resorted to.

The experience of the past summer differs from that formerly known in that the insects were found upon all parts of the tree instead of remaining upon the lower branches as was heretofore supposed. They are thus made more difficult to reach. When the lice are first hatched they are very small and delicate. A wash containing an alkaline solution applied at this time is sufficient to destroy them. I found that by attaching a wire bag to a common sprinkling hose, filling the bag with soft soap and turning on the water, a soap-suds was formed which would at once kill the insects; the scarcity of the water system in small cities renders this plan impracticable, and experiments led to one plan, easily attained by all, and which proved successful the past season.

The plan recommended is as follows: Charge a fire extinguisher in the usual manner with bi-carbonate of soda and sulphuric acid; add to the water one spoonful of crude carbolic acid to every eight gallons of water. Apply this to the tree and the force from the extinguisher will convey the fluid to all parts of the tree alike; the disposition of the insects to settle upon the lower surface of the leaf and limb serve to further this plan. Two applications should be made upon the same tree; the first, three weeks after first deposition of eggs, and the second, four weeks from the first application. If the work is delayed the insects become strong and the strength of the solution must be increased, which would be liable to injure the tree itself. The actual cost is not exceeding twenty cents an application, which is trifling compared to the cost of replacing the tree. That the experiment may prove successful it is necessary to make the work thorough throughout a locality, since in a short time they return from the infested trees.

Examining the male *L. acericorticis* since my previous article, I find my doubts confirmed with reference to the non-existence of the two halters or balancers in the place of lower wings. After close examination with a high power and living specimens, I fail to find them, and conclude that in this species they do not exist, or if at all, in a rudimentary state.

M. V. Signoret states that when the male *Lecanium* is prepared to come out it lifts that membrane which rests slightly fixed by the head end. Observation with this species shows this is not reliable with all *Lecania*. When the male of this species is about to emerge from the larval scale, it backs out with the wings closely adhering to the body. The empty scales will, upon examination, be found closely attached to the leaf or limb at the head end, while at the opposite end it is loosened.

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RECENT LITERATURE.

MACALISTER'S ZOÖLOGY OF THE VERTEBRATES.[1] — This little manual is chiefly concerned with the morphology of the classes and orders of vertebrate animals, with slight, condensed references to their habits, physiology and classification, but with no chapters treating of their zoö-geographical distribution, or geological suc-

[1] *Zoölogy of the Vertebrate Animals.* By ALEX. MACALISTER, M.D. Specially revised for American Students, by A. S. PACKARD, JR., M.D. New York, Henry Holt & Co., 1878. 12mo, pp. 134, with 59 figures.

cessors, or their relations to lower forms of life, or to their environment; nor is anything said regarding the mode of development of these animals. However, as a compact, concise, clearly written and useful manual of the morphology of vertebrates, it is well adapted for the use intended by the author, viz: "To present in as clear a form as possible the leading characters of vertebrate animals." As such we recommend its use in colleges and high schools, and to the general reader, though in these days the latter class of book buyers desire, as a rule, a book combining morphology and biology, with general views of the relation of animals to their surroundings, as well as their relations to fossil forms. It should, however, in justice be said, that all this could not be contained in a book of the size of the present one.

While we have no fault to find with the matters of detail, we would suggest that in the light of recent discoveries, it is old-fashioned and unphilosphical to regard the fourteen groups of carinate birds as "orders."

The wood-cuts are from well selected subjects, and are, with scarcely an exception, excellent, while the paper, press-work and binding render this little hand-book, like others of the series, both attractive and convenient.

FOSTER AND LANGLEY'S ELEMENTARY PRACTICAL PHYSIOLOGY.[1]—This well known book, so useful to students of anatomy, histology and physiology, has passed to a third edition, which differs from the preceding one chiefly by the introduction of a lesson on the structure of the ear, and by some additions to the lessons on the connective tissues. As it now stands the book is indispensable for medical students, and for biologists who have used Huxley and Martin's Biology and desire to extend their studies to histology and physiology. Its extensive use among naturalists is most desirable, to draw them away from "skin and bone" as well as systematic zoölogy, to a study of the living organism, and thus ultimately to the more general relations of animals to each other and their environment.

IHERING'S PERIPHERAL NERVE-SYSTEM OF VERTEBRATES.[2]—This elaborate essay treats of the following subjects: The peripheral system of nerves as regards the knowledge of the formation of regions in the vertebral column; the idea of segments in the vertebrates and invertebrates; a general phylogeny of the peripheral nerve-system and the formation of regions of the vertebral column. The chapters on these subjects are followed by a special account of these nerves in the different

[1] *A Course of Elementary Practical Physiology.* By M. FOSTER, M.D., F.R.S.; assisted by J. N. Langley, B.A. Third edition. London, Macmillan & Co., 1878. 12mo, pp. 276.

[2] *Das Peripherische Nervensystem der wirbelthiere als Grundlage für die Kenntniss der Regionenbildung der Wirbelsäule.* Von HERMANN VON IHERING. Mit 5 tafeln und 36 holzschnitten. Leipzig, Verlag von F. C. W. Vogel, 1878. 4 o, pp. 238.

classes of vertebrates. Regarding segmentation in vertebrates as compared with invertebrates, our author considers the body-segment of a vertebrate not as a single organ, but as the combination of a neuromere arising from the ectoderm with the scleromere and myomere arising from the mesoderm, which arise independently of each other and are not in any way to be taken together. Such an antithesis between the neuromere and the other organ-segments do not exist in the segments of the Articulates. Ihering also expresses the opinion that Semper's revival of the hypothesis of Geoffroy St. Hilaire and Treviranus is a matter rather of personal convictions than a subject for scientific discussion. This hits the nail on the head. He also shows that in vertebrates the new segments of vertebrates, in early life, are terminal; while the new segments of articulates are interpolated between the penultimate and terminal segments of the body. The law for articulates is not new to American students,[1] though only German and Swiss authorities are quoted in the present work.

The Principal Characters of American Cretaceous Dinosaurs.—Prof. Marsh, in the November number of the *American Journal of Science and Arts*, gives an account of the characters of several genera of saurians from the Rocky Mountain region. This paper gives us, for the first time, the characters of their ilium and the mode of its junction with the pubis and ischium, and the structure of the feet and of the axis vertebra, all points of great value to comparative anatomy and palæontology. He also extends to certain genera, characters of the skeleton which have been already determined in nearly allied forms. He proposes for them all a new division of the *Dinosauria* which he terms *Sauropoda*, with the following definition: (1.) Fore and hind limbs nearly equal in size. (2.) Carpal and tarsal bones distinct. (3.) Feet plantigrade, with five toes on each foot. (4.) The precaudal vertebræ contain large cavities apparently pneumatic. (5.) The neural arches are united to the centrum by suture. (6.) The sacral vertebræ do not exceed four, and each supports its own transverse process. (7.) The chevrons have free articular extremities. (8.) The pubes unite in front by ventral symphysis. (9.) The third trochanter is rudimentary or wanting. (10) The limb bones were without medullary cavities.

We remark, with reference to the above definition, that it embodies the characters of a well-marked division of reptiles, but that many of the characters given do not have such significance; or, in other words, do not possess the value which Prof. Marsh attaches to them. Thus, while some of them should be retained, Nos. 1, 4, 5, 7 and 10 must be rejected.

An important improvement over his previous essays is noticeable in this one, in that the author gives a definition for the only new genus proposed, viz: *Diplodocus*, which is, therefore, a real addi-

[1] See Packard's Guide to the Study of Insects.

tion to scientific nomenclature. But, on the other hand, Prof. Marsh does not deviate, throughout this paper, from his usual habit of ignoring the work of contemporary naturalists.[1] We cite the following instances: The division called by Marsh *Sauropoda*, was named by Owen, thirty-seven years ago, the *Opisthocœla*, and more recently by Seeley, the *Cetiosauria* (the latter name without definition). Several genera of the group have been determined by other authors, of which no mention is made, while new names are given them. Such is *Caulodon*, which at a later date is termed *Morosaurus;* and *Camarasaurus*, from which *Atlantosaurus* of later origin has never been distinguished. The name *Apatosaurus*, introduced as "described by the writer," is an equally unknown quantity in palæontology.[2] The various descriptions of the characters of the limb and pelvic bones, and of the skeleton in general, are all given as though new, the recognition of work done by others, usually thought indispensable in scientific literature, being quite omitted. A reference is made, however, to the early determination of the age of the beds in which some of these fossils were found by Dr. Hayden and Prof. Cope, as erroneous; but the author fails to notice the later views of Prof. Cope, in which he corrected both Prof. Marsh[3] and the determinations which were made before him.

Meehan's Native Flowers and Ferns.[4]—We are glad to notice the increasing number and value of our popular works of natural history. Such handbooks have long been common in England and on the Continent, but somehow we, in America, have not had them. Works like these, however, seem now to be much in demand. They undoubtedly have, when well conducted, an educational influence. The name of Mr. Meehan is a guarantee for the excellence of the text. He gives a pleasant conversational account of each flower, and contrives at the same time to introduce much interesting scientific matter, which may lead the reader to personal research. Herein lies the value of these illustrated manuals. He who comes to them for amusement may tarry for information. One part is to be issued every two weeks, and will contain four colored plates. Mr. Alois Lunzer has here produced very satisfactory work. Indeed, we are at a loss to see how the Messrs. Prang & Co. can furnish so much for so small a sum; the price of each part is but fifty cents, while both letterpress and plates are elegant. A somewhat familiar acquaintance

[1] An apparent exception, is that of a distinguished English palæontologist, who is noticed in a foot note, but his precise service, that of the determination of the structure of the pelvis in *Iguanodon*, is unfortunately not specified.

[2] I note here that the supposed new genus of *Mammalia* recently noticed by Prof. Marsh as derived from the same beds, is in a similarly unsatisfactory condition, not the least ground for its creation having been given.

[3] Proc. Amer. Philos. Soc., 1877, p. 234.

[4] *The Native Flowers and Ferns.* By Thomas Meehan. Boston, L. Prang & Co., 1878.

with our wild flowers in most of their moods, makes us critical in a few instances as regards shades of color. But where there is so much that is excellent, the office of fault-finder is gratuitous. We especially commend the drawings of *Pachysandra procumbens* and *Polypodium incanum*. In still another respect this work has a direct scientific bearing, as Mr. Meehan introduces so many references to current botanical literature. The undertaking ought certainly to succeed.—*W. W. B.*

TAYLOR'S FLOWERS.[1] — This little book which, in about six months, has passed into a second edition in England, should be better known in this country. The author has, with great skill, presented in a popular form the most recent results of botanical research. In so doing he has not fallen into the habit, all too common, of theorizing for himself or poetizing for others. He is in full sympathy with modern thought, and in his opening chapter on the old and the new philosophy, distinctly states his position. He shows that the time has gone by when man is to hold that the beauty of flowers, or their useful or noxious qualities were designed in reference to him alone; that it is a nobler conception, and one, moreover, sustained by facts, that they are contrived in subservience to their own needs and their special environment. This chapter in itself is a most delightful essay. In it reference is made to the researches of Darwin, Müller, Bates, Bell and others upon cross-fertilization by insects and humming birds. The author is well read in the literature of his subject. He next discusses the geological antiquity of flowers and insects, the geographical distribution of plants, their structure and their relations to their surroundings. The colors, shapes, perfumes and defences of flowers, all have appropriate treatment in special chapters, and it is impossible in a short notice to convey to the reader an adequate idea of the vast amount of information here condensed into accessible shape. The very latest data from the *Challenger* and the British Arctic Expeditions are incorporated. To add to the merits of the volume, it is superbly printed, and illustrated with 32 colored figures by Sowerby, together with 161 woodcuts.

Says the author: "Every day we are proving that 'man liveth not by bread alone'; and that sunny blue skies, laughing streams, and flower-bedecked fields are full of lofty and even spiritual teachings. The organic unity of Creation, for which thinkers have long sighed, and labored, and suffered, has appeared above the horizon, and is each day becoming more manifest to us. A clearer conception of Creational Power and Wisdom must naturally spring from more correct ideas of the laws by which the Life of our planet originated, and which still continue to govern it."

In conclusion, this is a book which we would gladly put into

[1] *Flowers; their origin, shapes, perfumes and colors.* By J. E. TAYLOR, Ph.D., F.L.S., etc. Second edition. London, Hardnicke & Bogue, 1878. 16mo.

the hands of the young. It will, we think, stimulate to observation and even to original research. If it does no more, it must surely lead to correct and logical views of the facts of nature. It will make a good Christmas gift for thinking boys, and will afford them healthy and inspiring recreation. When saying this, however, we do not desire to convey the idea that it is in any sense a "boys' book." It offers as rich entertainment for the adult.—*W. W. B.*

FLEMING'S GEOGRAPHY OF THE CANADIAN PACIFIC RAILWAY.[1]—This report is of particular interest as giving a résumé of the knowledge recently acquired regarding the physical geography of British Columbia and the interior of British America The map, showing various projected lines of the Canadian Pacific Railway, is a compact presentation of existing knowledge of this region, and is consequently of much use to American students.

RECENT BOOKS AND PAMPHLETS.—Pacific Coast Lepidoptera, No. 26. Description of two new forms of diurnals. By Henry Edwards. (From the Proceedings of the California Academy of Sciences, December, 17th, 1877.) 8vo, pp. 14.

Sketch of the Life and Scientific Work of Prof Charles Fred. Hartt. By Richard Rathbun. (Read before the Boston Society of Natural History, April 17th, 1878.) 8vo, pp. 26.

Remarks of Robert E. C. Stearns before the California Academy of Sciences on the Resignation and Farewell of Vice-President Henry Edwards, August 19th, 1878. 8vo, pp. 3.

Surveys by the War Department. Letter from the Secretary of War in response to a Resolution of the House of Representatives giving information concerning the surveys conducted by the Department in the last ten years. Washington, May, 1878, 8vo, pp. 8, and map.

Report on the Insect and other Animal Forms of Caledonia Creek, New York. By J. A. Lintner. (From the Tenth Report of the New York State Commissioners of Fisheries, August, 1878.) 8vo, pp. 26, 3 plates.

On the Willemoesia Group of Crustacea. By C. Spence Bate. (From the Annals and Magazine of Natural History, for October, 1878.) Read at the meeting of the British Association, at Dublin, August 19th, 1878, 8vo, pp. 11, 1 plate.

Neue exotische Hesperidae. Beschrieben von H. B. Möschler. (Aus den Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien, Jahrgang 1878, besonders abgedruckt.) 8vo, pp. 28.

On the Mineralogy of Nevada. By W. J Hoffman, M. D. (Extracted from the Bulletin of the Survey. Vol. iv, No. 3, Department of the Interior. F. V. Hayden, U. S. Geologist-in-Charge. Washington July 29, 1878.) 8vo, pp. 15.

On the Nauplius Stage of Prawns. By C. Spence Bate. (From the Annals and Magazine of Natural History for July, 1878.) 8vo, pp. 8.

Die prähistorischen Kupfergeräthe Nordamerikas. Von Dr. Emil Schmidt in Essen a. d. Ruhr. (Hierzu Taf. iv, v, vi.) 4to, pp. 42, 3 Plates.

Journal of the American Geographical Society of New York, 1875, 76, Vols. vii and viii. Albany, 1878. 8vo.

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[1] *Canadian Pacific Railway.* SANDFORD FLEMING, C. M. G. Engineer in-Chief. Reports and Documents in reference to the location of the line and a western terminal harbor. 1878. Ottowa, 1878, 8vo, pp. 104, 3 maps.

GENERAL NOTES.

BOTANY.

VOLVOX GLOBATOR.—Although this minute organism has long been a favorite object for observation under the microscope, its structure has only recently been fully worked out by Prof. F. Cohn, of Breslau. Its reproductive organs are now found to be of a highly complicated structure, indicating its proper position in a comparatively high class of Cryptogams, with a marked affinity, in some respects, to the Fucaceæ. It must, at all events, be placed in Sachs' class Oösporeæ.

The Volvox is a minute pale-green globule just visible to the naked eye, about one-fiftieth of an inch in diameter, rolling about rapidly in clear water, owing to the action of innumerable fine, transparent vibratile cilia with which the surface is studded. These cilia are arranged in pairs, each pair belonging to a separate peripheral corpuscle or cell, each of which contains a green protoplasm-body, a minute starch-granule, a reddish brown "eye-spot," and one or two contractile vacuoles, the cilia being borne at the narrow hyaline end. Each is surrounded by a gelatinous envelope, which is pierced by a number of canals, all lying nearly in one plane, and filled by green or colorless extensions of the protoplasmic interior. Since the canals of adjoining cells correspond, the corpuscles appear as if connected together by a network of fine reticulations. The outer gelatinous wall of each cell is also perforated by two pores, through which the two vibratile cilia project into the surrounding water. These cells have, as far as is known, no reproductive function. Besides these non-reproductive or sterile cells, each Volvox colony includes three kinds of reproductive cells, non-sexual, male and female. The non-sexual reproductive cells, or parthenogonidia, are similar in structure to the sterile cells, but two or three times their size, *i.e.*, from .006 to .009 mm. in diameter. They multiply by repeated bipartition, this process having been followed by Cohn until the original cell has divided into sixteen. The young colony is surrounded by a transparent membrane, which it at length breaks through, and carries on an independent existence within the cavity of the mother colony, each of its cells developing a pair of cilia; finally it escapes into the surrounding water. The usual number of parthenogonidia which thus develop into infant colonies within the mother-colony is eight. The sexual reproductive cells are very few in proportion to the sterile cells, and appear to be formed only in the autumn, and the two kinds, male and female, are found either in the same or in different colonies; and the sexual generation forms the close of a larger or shorter series of non-sexual generations. The female cells or gynogonidia are at first undistinguishable from the parthenogonidia, but are much more numerous, and very early form chlorophyll. They

have, at first, a frothy appearance from the formation of vacuoles, but afterwards appear to be filled with protoplasm. They soon become flask-shaped, their narrow end touching the periphery of the sphere, and the larger end hanging free into the cavity. When ready for impregnation they round themselves off into a spherical form, and may then be designated oöspheres, each being enveloped in a gelatinous membrane or oögonium. The androgonidia, or male cells, also contain chlorophyll; they divide but only in two directions, thus developing not into a sphere but into a plate of cells. They ultimately resolve themselves into a bundle of naked primordial cells, each consisting of an elongated body in which the chlorophyll has been transformed into a reddish-yellow pigment, and of a long colorless beak, to the base of which are attached two very long vibratile cilia, and where also is a red corpuscle or "eye-spot." The whole androgonidium may now be regarded as an antheridium enclosed in a gelationous envelope, each of the naked protoplasmic bodies being a mobile antherozoid or spermatozoid. The movements of the vibratile cilia eventually cause the antheridium to break up, the separate antherozoids setting up a rapid independent motion within the gelatinous envelope of the antheridium, which they ultimately break through, and then move about rapidly in all directions within the cavity of the mother-colony. They assemble in large numbers round the oögonia, and some of them finally penetrate through the gelatinous envelope of the latter, and coalesce with their protoplasmic contents or oöspheres. The fertilized oösphere is now an oöspore, and develops a new cell-wall, the epispore, which is at first smooth, but afterwards covered with conical elevations, giving a section of it a stellate appearance. A second perfectly smooth membrane, the endospore, is subsequently found within the first. The chlorophyll gradually disappears, and is replaced by an orange-red pigment dissolved in oil, so that the mature oöspore, while still enclosed within the mother-colony, is of a light-red color, causing the red tinge which Volvox often presents, even to the naked eye, at certain periods of the year. Soon after the oöspores reach maturity, the mother-colony breaks up, single cells escaping from the combination, and swimming about freely in the water; their further history is unknown. The oöspores fall to the bottom and there hibernate. Their further development has only been observed by Cienkowski, who states that the contents of each spore break up into eight spheres which ultimately break out.

Full details of these interesting processes, with admirable illustrations, will be found in Cohn's Beiträge zur Biologie der Pflanzen, Vol. i, Heft 3.—*Alfred W. Bennett.*

A DOUBLE-FLOWERED CYPRIPEDIUM SPECTABILE.—In describing this flower it is viewed as it hangs on the stem in its natural position, having a right and a left side, the observer facing the open flower.

The parts in their natural place are the outer sac, the lower sepal, the stigma and the two pollinia. The lower sepal is broader than is usual, the stigma deeply two-lobed and twice the ordinary width. The right-hand pollen-mass is doubled, the third one standing at the apex of the angle made by the two barren stamens. These stamens are of the ordinary size, and face each other at an angle of 80°. The upper part of the flower may be regarded as composed of two single flowers, together occupying about 240° of a circle, the lower sepal being the only part in the remaining space. There are a sepal and two petals on the upper left side, and the same on the upper right, each part of the usual size. The natural flower is the left one to which the outer sac belongs. Its right-hand petal is nearly vertical, where the upper sepal naturally stands. The left petal of the right-hand flower stands directly behind this, and has grown by one edge to the edge of the upper or involucral leaf, which in turn is grown by the remainder of the same margin to the ovary, so as to be adherent all the way from the base of the ovary to the top of the petal.

The ovary is enlarged, one-celled, with four parietal placentæ; some of the placentæ are uncommonly broad, and are probably doubled, though so closely connected as not to be distinguished. One sac is contained in the other, but entirely free, and readily drawn out. The inner sac belongs to the right-hand flower, its claw being a little to the left of that of the outer. Though contained in the outer, it is really larger when inflated, being crumpled as it is packed away. The flowers are large, the sacs being two inches long.

From the position of the parts, which were carefully compared with fresh specimens of the single flower, it is probable that this monstrosity arose from two buds, starting from the same point of the stem, and adhering by their inner faces, those parts only being doubled in reality, for which room for development was found, the doubling of the rest being disguised in the enlarged parts that represented them. Most of the specimens I have examined bear but two flowers, and almost always that number.

This flower was brought in a bouquet from some place in Indiana, the name of which I could not learn. It is found abundantly in the peat bogs and margin of sloughs in the pine barrens of Lake Co., Ind. I have since been told that it is not unusual to find these double flowered Lady's Slippers, though it is the first that has come under my observation, or that of any of my botanical friends to whom I have mentioned it.—*E. J. Hill.*

A New Variety of Campanula rotundifolia L.—While collecting plants in the northern part of Michigan the past summer, I discovered a form of this plant that I do not find mentioned. It differs from the ordinary forms in being densely pubescent, or hoary with short, reflexed hairs, at least on the lower part of the stem and leaves, some plants being smooth or somewhat so above.

Usually the flower alone is smooth. The stems are generally stout and clustered, from one to two and a half feet high. There are often from eighteen to twenty flowers on a stem. This abundance of flowers seems to characterize nearly all of my specimens of *C. rotundifolia* gathered along the shores of Little and Grand Traverse bays. In Gray's *Synoptical Flora*, our latest authority, the plant is said to be 1–9 flowered. Most of mine exceed this. One stem has thirty-two in different stages of growth. I propose for this variety the name *C. rotundifolia var. canescens*. It grows on sand hills at Indian river, near the outlet of Burnt lake, Sheboygan Co., Mich.—*E. J. Hill, Englewood, Ill.*

Mr. J. L. Bennett, of Providence, R. I., informs us that a form exactly similar to this, save in the abundant flowers, is found in Greenfield, Franklin Co., Mass.; the amount of canescence differs very much, even in the same plants, some stems being very nearly smooth, while others are quite hoary; different portions of the same stem also varying greatly.—*W. W. B.*

Extirpation of a Plant.—Though attributed to Southern Florida, where it is still common, the coontie (*Zamia integrifolia* Willd.) is found to extend as far north as Alachua, Bradford and adjoining counties of this State, and, at one time, I understand, was most abundant in the localities named. But of late it is comparatively rarely met with in this region, and in many wide ranges has totally disappeared. Where hogs are kept, and are allowed to roam at large, as is usually the case in Florida, the plant, I am informed, is soon extirpated, those animals ravenously devouring it, and I have traveled over many miles of this territory without meeting a single Zamia. Its stem is rich in starch, and from it is made the coarser description of Florida arrowroot. Hence its attraction for the hog. Any one who has seen, as I have, the manner in which this animal attacks and uproots so difficult a subject as the young saw-palmetto (*Sabal serrulata* R. and S.) can easily understand what short work it would make with the coontie. Belonging to the *Cycadaceæ*, its pinnate leaves and palm-like aspect give the *Zamia* a peculiarly ornamental and attractive appearance, and its vanishing from so wide a field is much to be regretted. As Florida becomes more thickly settled, the total extirpation of the plant, except in its more southern habitat, and where taken into cultivation, may prove to be a not unlikely event, from the cause mentioned, and also from its use by man in manufacturing starch and arrowroot.—*Henry Gillman, Waldo, Florida.*

The Structure and Affinities of Characeæ.—In recent numbers of the London *Journal of Botany*, Mr. A. W. Bennett and Prof. Caruel discuss this subject; both these botanists dissenting from Sachs's location of the *Characeæ* (in the fourth edition of his Jahrbuch der Botanik) among the *Carposporeæ*, a

class of Thallophytes. Mr. Bennett points out that not only do the *Characeæ* differ from Thallophytes in the most essential points of structure of that class, viz: in possessing a distinct axis and branches; they do not, either display the distinguishing characteristics of the *Carposporeæ*, viz: the formation, as the result of the impregnation of the female organ, of a sporocarp consisting of two essentially different parts, a fertile part and an envelope or pericarp which is not derived directly from the female organ. Mr. Bennett also calls attention to the fact that the term "proembryo" has been misapplied by many writers to the structure which proceeds immediately from the germination of the spore of Chara, and which is rather a prothallium or a protovum; and again that the *Characeæ* are incorrectly described by some as displaying the phenomenon of alternation of generations. The term alternation of generations implies two distinct starting points in the life-history of the plant, impregnation and germination; the sexual generation consisting of the stage intermediate between germination and impregnation, the non-sexual generation, of the stage intermediate between impregnation and germination. In *Characeæ*, almost alone among Cryptogams, the oöspore or fertilized oösphere germinates immediately in the soil without the intervention of a non-sexual generation. Caruel, for reasons assigned in his new system of classification, to which we have already referred, insists on placing the *Characeæ* by themselves as a primary group of the vegetable kingdom, under the name *Schistogamæ*, intermediate between Phænerogams and vascular Cryptogams.—*A. W. Bennett.*

Botanical News.—In a short paper by Dr. Ewart, on the Life-history of *Bacterium termo* and Micrococcus, the author regards it provisionally as distinct from Bacterium. His observations on *Bacterium termo*, especially, with reference to the effects of desiccation, of different temperatures and of ebullition will be of value in future researches of like nature. Mr. Geddes and Dr. Ewart describe also in the Proceedings of the Royal Society the life-history of Spirillum, and they conclude that "the forms described by various authors as Vibrio are merely either (1) Zigzag dividing Bacillus; (2) slightly waved Bacillus; or (3) undeveloped Spirillum, and hence that Vibrio should no longer be used as a generic term." The *New Italian Botanical Journal* for July 30, contains Delpino's defence of his dichogamic doctrine, with a brief appendix by T. Caruel, the editor. In Trimen's *Journal of Botany*, for October, J. B. Balfour describes some points in the morphology of Halophila, and G. S. Boulger contributes an article on the placenta of *Primulaceæ*. The *Bulletin* of the Torrey Botanical Club, for September, contains a list of plants introduced with ballast and on made land in Jersey City; Lists of Long Island and Staten Island and Rhode Island plants are also given. Mr. Martindale contributes to the September number of the *Botanical*

Gazette, a notice of the occurrence of *Orobanche minor* in New Jersey. Dr. A. P. Garber writes in the October number of South Floridan ferns, while Mr. J. G. Lemmon writes in rather a gushing way of the big trees of California.

ZOÖLOGY.[1]

Breeding Habits of Corixa. — In Bulletin No. 1 of the Illinois State Laboratory of Natural History, I called attention, three years ago, in a paper on the Crustacea of Illinois, to a breeding habit of Corixa, which seems to have escaped the notice of the entomologists; and as my note has also been generally overlooked by those most interested, I repeat the observation here, especially as it affords a very curious illustration of natural selection, unless I wholly misunderstand the matter.

In temporary ponds of this region, which fill up every spring and dry out in midsummer, *Corixa alternata* Say, is an abundant insect, and *Cambarus immunis* Hagen, is the commonest craw-fish. In seining some of these ponds, three years ago, in June and July, I noticed that the backs of many of the crawfishes were covered with a moss-like incrustation, which, upon examination proved to be the eggs of insects, stuck fast by one end as close together as they could be placed. Sometimes only a few would be found on a crawfish, and sometimes the upper surface would be nearly covered. They were just hatching when first observed, and it took but a little time to determine that they were unmistakable Corixas. Careful search of the water weeds and other submerged objects failed to discover other eggs, and I was led to conclude that the Corixa purposely selected this remarkable place for oviposition. Since then I have found these eggs also on the shells of pond molluscs, and on the carapace of *Cambarus acutus* Gir., another wide-spread and common crawfish.

I can account for so strange a habit only by supposing that it is a "provision of nature" to guard against the waste of eggs otherwise resulting from the drying up of the ponds. The crawfishes mentioned are distinctively aquatic species, and as one pond dries up they migrate to another, or to a neighboring stream, bearing on their hospitable backs, as the shepherd bore Œdipus from impending destruction, the hopes of the distressed water bugs. If this is a fixed habit of a species or variety, and not a local accident, it ought to be heard of elsewhere.—*S. A. Forbes.*

Snakes and Cold Victuals.—It is a popular notion that serpents never eat what has been killed by any agency except their own; and, though naturalists know this belief to be false, very few of the one hundred and thirty-two species of North American serpents have been proved by actual observation to have eaten any animal which they have not captured alive.

[1] The departments of Ornithology and Mammalogy are conducted by Dr. Elliott Coues, U. S. A.

As the common black snake, *B. constrictor*, is not, to my knowledge, among the number already accredited with a propensity for cold victuals, an account of a black snake's dinner which recently came under my observation may be of some interest to those herpetologically inclined:

During the latter part of last June I killed a garter snake, *Eutænia sirtalis*, and the next day, happening past the place where I killed it, I came upon a black snake with about an inch of the tail of a garter snake protruding from its mouth. As I could see nothing of the dead snake left there the day previous, I immediately suspected the one inside his constrictorship to be the same. On removing the garter snake this proved to be the case, as was evidenced by the wounds I had made on the snake's head and body. The length of the black snake was a little short of three and a half feet, and that of his dinner, twenty-two inches.—*F. W. Cragin.*

A Skunk eaten by Turkey-buzzards.—Some years ago, while residing in Chester county, Penna., having set a steel-trap for a ground-hog (Maryland marmot), I found a large skunk caught by a leg. Though a very unwelcome prize, there seemed no alternative but to kill it, which was done. This was about 8 o'clock in the morning; immediately a number of turkey-buzzards commenced their usual gyrations over the dead body, and by 10 o'clock nothing remained of the unsavory animal but its well picked skeleton.—*William Kite.*

ANTHROPOLOGY.[1]

A Vessel of Glazed Pottery taken from a Tumulus in Florida.—The peculiar egg-shaped vessel surmounted with bulbous-shaped mouth, a description of which is here given, was found, associated with some much-decayed human bones, and a single arrow head chipped from reddish flint, in a burial mound near the south shore of Santa Fe Lake, Florida. The color of this unique piece of pottery is a dull shade of buff or drab. It is formed of yellowish clay, like that found in the neighborhood, perhaps mingled with marl; but without any admixture of crushed stone or shells being used in its construction. Its height is eleven inches, and its greatest exterior diameter 8.40 inches. It weighs six pounds, and holds over one gallon of liquid, or exactly four and one-third quarts, being perfectly water tight. Its base is too rounded to permit of its standing without support. The peculiarity of its construction is that it is built spirally from the bottom upward with one continuous cylinder or rope of clay, giving the vessel a ribbed or corrugated surface; there being twenty-four rounds or circuits of the cylinder. The entire inside is glazed with a decided but somewhat thin glazing of a pale yellowish tint. The bulbous-shaped mouth is

[1] Edited by Prof. Otis T. Mason, Columbian College, Washington, D. C.

also covered on the outside with a coating of the same preparation, which extends for the depth of about one inch below the neck, over which is a second and thicker coating of glaze of a cream color with greenish cast. With this exception the outside is unglazed. In applying the glazing, some of the material has streamed down the side of the vessel, which is also spotted in several places with drops of the vitreous substance. The glazing is in an excellent state of preservation, though marked with the reticulation of fine cracks such as may be seen in even our modern pottery when it has been in use for a considerable length of time. The entire workmanship of the specimen is of a much rougher and ruder character than the fact of its being glazed would imply. On the outside, at a point 2.30 inches below the contracted neck, occurs an annular indentation, the greatest diameter of which measures 0.54 inch, its least diameter being 0.52 inch. This, which, with the exception of the border of glazing around the neck, is the only attempt at anything like ornamentation in this piece of pottery, has some indication of being the personal stamp or brand of the maker.

It is believed that this is the first vessel of glazed pre-historic pottery taken from a mound in Florida, or perhaps from one in any other part of the United States, or at least the first east of the Rocky Mountains, of which any account has been given. Wyman makes no mention of such, though he speaks of having "found indications that some at least of the vessels were made by coiling up long cylinders of clay, and afterwards pressing and welding them together." Dumont, in his elaborate account of the manufacture of pottery by the Indians of Louisiana, though accurately describing the forming of vessels by spirals made with cylinders of clay, is silent as to glazing. And so also with other writers. Some, indeed, make mention of glazing; but it is evident from their own explanations that simply a polishing and painting of the articles is meant, and not the vitreous coating to which the term in general is understood to apply.

It only remains to say that it is probable that the glaze on this peculiar vessel was produced by the use of salt. At least it is not of a calcareous nature, the test of acid failing to provoke effervescence.

Since writing the foregoing, my attention has been called by Mr. E. A. Barber to his interesting account in the AMERICAN NATURALIST for August, 1876, of the Pueblo pottery of the Far West, some of which is finely glazed, and which is found scattered over the surface of the country for hundreds of miles, though chiefly in the vicinity of the old mural ruins. A comparison of this highly advanced and probably much more modern pottery with the vessel here described, taken from an ancient mound in Florida, is not without its suggestiveness. Particularly is this the case from the fact that it is known that the modern Pueblo Indians

construct pottery by spirally coiling cylinders of clay, as has been above described in the case of the Florida pottery, though Mr. Barber states that they have lost the art of glazing.

Further details are given in a paper on the subject, read before the St. Louis meeting of the American Association, August, 1878.—*Henry Gillman, Waldo, Florida.*

An Indian Burial—Funeral Ceremonies at Lower Lake, California.—After the grave (a round hole of about five feet in diameter and the same in depth) had been prepared under a brush house, adjoining the cabin of the dead Indian, the body was carefully carried out in a blanket and quilt, and placed alongside the opening. The medicine man then began the funeral rites, which, in part, consisted of blowing a small whistle, and the shaking and rattling of split sticks, which made a peculiar noise like nothing but itself. After this had been kept up for some time, accompanied with the low, plaintive wails of the squaws who were sitting around the grave, and the louder lament of those in the house, the medicine man then pronounced a eulogy upon the dead, and exhorted the living. His language was accompanied with expressive gestures. He pointed to the sky, to the ground, to each of the four cardinal points, and, finally, into the grave itself, conveying the idea that after we had lived and enjoyed the things of this world, and wandered far and near over the earth, the time would come when a final separation of body and spirit must take place; and while the spirit ascended to regions above, the body must go into the ground and remain there, at least for a time. He then took the small whistle used by him and placed it in the mouth of the body, after which, with closed eyes and uplifted hand, he engaged in an invocation of some kind.

At the close of this, Rosa, the wife of the dead man, came from the house and cast herself full length upon the body. She removed the covering from Joe's breast, and, after she had laid her head upon it the covering was replaced, and her voice could be heard in low tones, as if bidding the departed a last farewell. After this a feather bed was brought out from the house and laid in the grave, the body was placed upon it in a half-sitting position; his gun, hat, shoes, some food, a basket containing silver coin, Indian money, beads, and feathers, were also put in with him. On top of all was thrown a straw bed. Rosa again began her lamentations, and, with a loud scream, tried to throw herself into the grave, but was withheld by a stout young squaw, who held her in her arms until the grave was filled. The first few handsful of dirt were thrown into the grave by the squaws; the men, then, with shovels, filled it up. After the dirt had been replaced, one of the squaws, with her hands, smoothed it over and obliterated all the tracks made by the workers. The medicine man again circles the grave three times, stopping each time at the

cardinal points, turning completely around, and finished by blowing the breath from his nose and mouth upon it.

Before digging the grave a number of chickens belonging to the dead man were killed and placed at intervals around the spot selected for sepulture, at a distance of twenty-five or thirty feet from it. The body was clothed with a new shirt and pantaloons, the forehead and eyes covered with a badge made of white beads, and a crown, or head-dress, of feathers above all. The cries and lamentations of the women were so plaintive, and their grief seemed so sincere, that there were but few dry eyes among the white bystanders who had come to see the last of old Joe Potoke. Before the company of mourners left the ground everything belonging to Joe was brought out from the house and broken up. Dishes, cooking utensils, knives and forks, buckets, and furniture sharing the same fate.—*Lower Lake (Cal.) Bulletin.*

ANTHROPOLOGICAL NEWS.—The second number of the *American Antiquarian*, edited by the Rev. S. D. Peet, contains the following articles: A Comparison of the Pueblo pottery with Egyptian and Greek ceramics, by Edwin A. Barber; Traditions of the Deluge among the tribes of the Northwest, by Rev. M. Eells; Description of an Engraved Stone by John E. Sylvester, M.D.; Prehistoric Ruins in Missouri; Gleanings, by S. S. Haldeman; Sketch of the Klamath Language, by Albert S. Gatschet; The location of the Indian tribes of the Northwest territory, by Stephen D. Peet; Remarkable Relics—Leaf Shaped Implements, by Prof. M. C. Reid. The paper of Mr. Barber is profusely illustrated, and shows considerable reading, but surely no one acquainted with the evolution of the art idea on our continent supposes that the Egyptians had anything whatever to do with it. With reference to Mr. Eells paper, and all ethnic stories of the same class, we shall have to lay down this canon, "As to matters of fact tradition is a tolerable guide to truth, while regarding matters of opinion it has no value whatever." The engraved stones, or tablets, seem to be the tender point with our western brethren. Dr. Sylvester's papers, backed up with affidavits, looks like the report of a Congressional committee. There is no doubt that much less temper would have been evoked by these objects if some of their admirers had not insisted on seeing in their rude lines symbols of something which never entered into the minds of those who manufactured them. Dr. Haldeman's gleanings consist of short notes on arrow-heads, tomahawks of honor, blunt arrow-heads, knives of cane, shaving, caves, charcoal, funerals, etc. The sketch of the Klamath language is by a master hand. The location of the Indian tribes by the editor is a contribution to a most important work. The author of these notes is gathering from every source, under the patronage of Major J. W. Powell of the Geographical Survey, materials for a classical dictionary of all the North American tribes. The information sought is the tribal

names in all their forms, both autonymous and heteronymous, their linguistic affinities, the original location and the migrations, the etymology of the names, and the chief authorities. Judge Henderson, of Winchester, Ill., read a paper before the American Association at St. Louis on the same subject. The notes are by Prof. E. A. Barber.

In noticing the Eleventh Annual Report of the Peabody Museum in the November number of the NATURALIST, sufficient emphasis was not given to the fact that Prof. Putnam claims to have discovered in the earthwork on the Lindsley estate, a map of which accompanies his paper, the vestiges of an ancient settlement. The work was a fortified camp, the large mound the site of some large edifice, the small circular banks the vestiges of houses, and the burial mounds the cemeteries of the dead.

It gives us great pleasure to record that the paper of Col. Garrick Mallery, read before the Nashville meeting of the American Association is attracting the attention which it deserves. The author was detailed, some two years ago, to work upon Indian matters in the office of Major J. W. Powell, geologist in charge of the U. S. Geographical and Geological Survey of the Rocky Mountain region. His previous training in literary matters had qualified him for the duties of a historical critic, and hence his research into the early aboriginal history of America led him to the conclusion that the former population had been greatly overestimated. Favorable notice has been taken of Col. Mallery's work in the British Association and in the Royal Society of London. Indeed, the question was seriously raised whether the conduct of the government in controlling its aboriginal population had not been too much influenced by the "melting away" doctrine.

The Rev. M. Eells has published at Portland, Oregon, a small book of hymns in the Chenook jargon language. It cannot be too strongly impressed upon those who have the opportunity that we cannot have too much of this linguistic material. Thomas Jefferson in his "Notes on Virginia," p. 193, wrote: "It is to be lamented then, very much to be lamented, that we have suffered so many of the Indian tribes already to extinguish, without our having previously collected and deposited in the records of literature the general rudiments at least of the languages they spoke."

In the October number of the *American Journal of Science and Arts*, Mr. W. J. McGee has a paper on the Artificial Mounds of Northeastern Iowa, and the evidence of the employment of a unit of measure in their erection. The author's profession has furnished him with abundant opportunities of measuring mounds, and he seems to have made good use of them. It was long ago supposed that a common standard had been employed by those who erected the earthworks of Ohio.

The Western Reserve and Northern Ohio Historical Society publishes, in No. 42, a paper by Col. Charles Whittlesey, entitled "Rock Inscriptions in the United States—Ancient Alphabets of Asia."

In Vol. i, Part 1, of Proceedings of the Central Ohio Scientific Association, of Urbana, Ohio, we have another evidence of the growing interest in science which manifests itself in our Western States. The principal contribution is a Report of the Antiquities of Mad River valley, by Prof. Thos. F. Moses, Urbana University, accompanied by eight plates of illustrations. Another valuable contribution to the archæology of Ohio which has hitherto escaped our notice, is the Final Report of the Ohio State Board of Centennial Managers, published in Columbus in 1877.

The following alphabet was prepared by Prof. Wm. D. Whitney to aid collectors in transliterating Indian vocabularies. The almost hopeless confusion in which the material already gathered is involved, is a sufficient motive for all writers on Indian linguistics to adopt it at once, or at least to show cause why they should not. The columns of this department are open to criticisms upon the subject:

a or *ā*, long as in *far, father*, Gm. *haben.*
a or *ă*, short as in Gm. *man*, Fr. *pas;* nearly as in (Eng.) *what, not.*
ă, as in *hat, man.*
â, as in *law, far, all.*
*ă*ⁿ, as Fr. *en* in *en, quand.*
*ā*ⁿ, as Fr. *in* in *vin, rien, sein.*
*â*ⁿ, as Fr. *on* in *on, son, rond.*
ai, as in *aisle*, Gm. *mein; i* in (Eng.) *pine, find.*
âi, as *oi* or *oy* in *oil, boy.*
au, as *ou* or *ow* in *out, how*, Gm. *haus.*
b, as in *blab*, Gm. *beben*, Fr. *belle.*
bʿ, nearly as *bh* in *cobhouse.*
bh, as Gm. *w* in *schwer, zwei.*
c (or *ch*), as *ch* in *church*, It. *cielo.*
d, as in *dread*, Gm. *das*, Fr. *de.*
dʿ, nearly as *dh* in *madhouse.*
dh, as *th* in *then, with.*
e or *ē*, long as in *they*, Gm. *beet.*
e or *ĕ*, short as in *then*, Gm. *belt*, Fr. *sienne.*
f, as in *fife*, Gm. *feuer*, Fr. *feu.*
g, as in *gig*, Gm. *gross*, Fr. *gros.*
gʿ, nearly as *gh* in *loghouse.*
gh, [nearly as Arab. *ghain.*]
h, as in *ha, he, hoot*, etc., Gm. *haben.*
hʿ, stronger aspiration.
hw, as *wh* in *when.*
hy, as in *hue.*
ī or *ı*, long as in *pique*, Gm. *ihn*, Fr. *île.*
i or *ĭ*, short as in Gm. *will*, Fr. *ici;* nearly as in (Eng.) *pick, thin.*
j, as in *judge.*
k, as in *kick*, Gm. *kamm*, Fr. *quand.*
kʿ, nearly as *kh* in *inkhorn.*
kh, as Gm. *ch* in *ich, milch, kirche.*
l, as in *lull*, Gm. *lallen*, Fr. *lilie.*
ly, as It. *gl* in *moglie*, (old) French *briller.*
m, as in *mum*, Gm. *memme*, Fr. *me.*

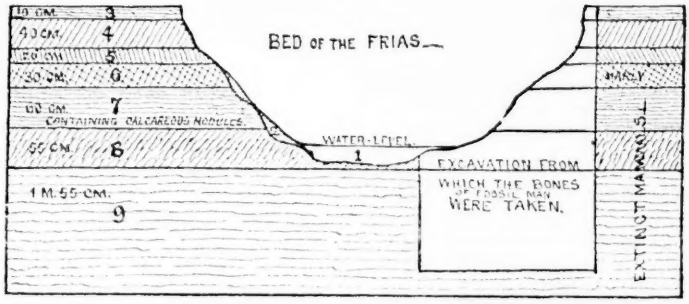
n,	as in *nun*, Gm. *nonne*, Fr. *ne*.
ñ,	as *ng* in *singing*, Gm. *singen*.
ny,	as Sp. *ñ* in *cañon*, Fr. *gn* in *règne*.
o or *ō*,	long as in *note*.
o or *ŏ*,	short as in (N. E.) *home*, Gm. *soll*, Fr. *mot*.
p,	as in *pipe*, Gm. *puppe*, Fr. *poupe*.
p',	nearly as *ph* in *topheavy*.
ph,	as Gm. *f* in *pfeil*.
qh,	as Gm. *ch* in *ach*, *doch*, Scottish *loch*, Sp. *j* in *hijo*.
r,	as in *roaring*, Gm. *rühren*, Fr. *rare*.
rh,	uvular *r*.
s,	as in *sauce*, Fr. *sauce*, Gm. *weissen*.
sh,	as in *shun*, Gm. *schon*, Fr. *chair*.
t,	as in *trot*, Gm. *treten*, Fr. *tâter*.
t',	nearly as *th* in *masthead*.
th,	as in *thin*, *truth*.
u or *ū*,	long as in *rule*, *fool*, Gm. *du*, Fr. *doux*.
u or *ŭ*,	short as in *pull*, *soon*, Gm. *null*, Fr. *nulle*.
û,	as in *but*, *run*; *son*, *blood*.
ûn,	as Fr. *un* in *un*, *brun*.
ü,	as in Gm. *kühl*, *küssen*, Fr. *plume*.
v,	as in *valve*, Gm. *wenn*, Fr. *veux*.
w,	as in *wish*, *will*, *wayward*, nearly as Fr. *oui*.
y,	as in *yeu*, *year*, Gm. *j* in *ja*.
yu,	as *u* in *use*, *pure*, *mew*, *feud*.
z,	as in *zones*, Gm *hase*, Fr. *zèle*, *rose*.
zh,	as in *azure*, *s* in *pleasure*, *fusion*, Fr. *juger*.

Foreign.—The October number of the *Revue d'Anthropologie* of Paris, contains the following communications: Note sur un tumulus préhistorique de Buenos Ayres, par M. Estasnilas Ceballos; Etude sur les Soninkés (Sénégal), par le Dr. Bérenger-Féraud; Le crâne des noirs de l'Inde (Tribu des Maravars) par M. E. Callamand; Notes sur les Bahnars (Cochin chine), par le Dr. A. Morice. Among the valuable reviews is the following in connection with the great Exposition: Congrès international des sciences anthropologiques, séance d'ouverture; Discours d'ouverture du Président, M. Paul Broca; Rapport sur les Societés d'anthroplogie, par M. Thulié; Rapport sur l'anthropologie générale, par M. P. Topinard; Rapport sur l'ethnologie, par MM. Girard de Rialle et Bordier; Rapport sur le Préhistorique, par MM. G. de Mortillet, E. Cartailhac, et E. Chantre; Rapport sur le Démographie, par M. Chervin.

GEOLOGY AND PALÆONTOLOGY.

The Man of the Pampean Formation.—The accompanying cut, for which, with the accompanying notes, we are indebted to Prof. Ameghino, of Mercedes, Buenos Ayres, exhibits a transverse section of the stream Frias, demonstrating the geological constitution of the strata at the point where the fossil man of Mercedes was found, together with a plan of the excavation made in exhuming the remains.

The Frias flows through a horizontal plain of uniform geological structure; its depth is from 2 m. to 2.30 m., its bed being scooped out of the pampean strata. Number 1 indicates the



water-level; 2, is a thin layer of gravel as found in excavating on the right side of the stream, and which was material deposited by the stream which it had washed from more elevated portions of its bed; number 3 is a layer of vegetable mold 10 cm. in thickness, which contains numerous bones of domestic animals introduced into the country since its occupation by Europeans; number 4 is a stratum 40 cm. in thickness, and contains the bones of animals indigenous to the country, and number 5 is a very clayey stratum 20 cm. in thickness, and contains the bones of extinct species of animals, but in a poor state of preservation; number 6 is a marly layer 30 cm. in thickness, in which the bones of the great extinct mammals, *Mylodon*, *Glyptodon*, etc., are found; number 7 is 60 cm. in thickness, is not nearly so marly as the preceding, and also contains remains of extinct animals; number 8 is 55 cm. in thickness, of a reddish color, and is composed exclusively of fine sand and clay mixed together. The stratum, number 9, which is more than 1.5 m. in thickness, is only distinguished from the preceding in that it contains a larger proportion of clay. In this layer of pampean soil, at the base of the excavation indicated in the diagram, and at a lower level than the bed of the stream, there were human bones discovered, together with rudely-shaped flints, apparently used in extracting the marrow from bones, a perforated femur of *Eutatus*, bones with incised and some with radiate markings and striæ, fragments of burnt bones, fragments of burnt or baked earth and a great quantity of charred vegetable substances. In the same deposit, mingled with the objects mentioned, there were also a great many bones of animals found, which indicated the following species:

1. *Hoplophorus ornatus* (Owen). A great part of the carapace and some bones.

2. *Hoplophorus* sp. indet. A portion of the carapace and other bones.

3. Skull and a large portion of the skeleton of *Eutatus* of a new species.

4. Portion of the carapace and bones of a very small armadillo of an undetermined species.

5. The skeleton of *Canis protalopex* (Lund).

6. Bones of many individuals of *Lagostomus angustidens* Burmeister.

7. Some bones of an undetermined species of horse.

8. Teeth and bones of *Cervus pampæus* Bravard.

9 and 10. Bones of many rodents of the genera *Reithrodon* and *Hesperomys*.

11. A species of *Dolichotis*.

12. Bones of a carnivore, which Prof. Gervais thinks appertain to a young *Machairodus*.

13. An ostrich [*? Rhea*] and many other bones belonging to undetermined species.

THE THEROMORPHOUS REPTILIA.—A paper on this subject was read by Prof. Cope before the National Academy of Sciences at its recent meeting in New York, on November 7, 1878. He stated that he had determined that the scapular arch in the *Pelycosauria*[1] consists of scapula, coracoid and epicoracoid, which form a continuum in the adult, in the same way as the three elements of the pelvis in the same group form an os innominatum. He showed that the tibiale and centrale of the tarsus unite to form an astragalus, which has no movement on the tibia. The fibulare forms a calcaneum. The distal side of the astragalus presents two faces, one of which receives a large part of the proximal extremity of the cuboid.

The structure of the scapular and pelvic arches was stated to be identical with that already described by Owen as belonging to the *Anomodontia*. Several important characters distinguish this group from the *Pelycosauria*, but the two together form an order which Prof. Cope thought would have, for the present at least, to be retained as distinct from the *Rhynchocephalia*. The characters of this order, with its two sub-orders were given as follows:

THEROMORPHA Cope. Scapular arch consisting at least of scapula, coracoid and epicoracoid, which are closely united. Pelvic arch consisting of the usual three elements, which are united throughout, closing the obturator foramen and acetabulum. Limbs with the phalanges as in the ambulatory types. Quadrate bone proximally united by suture with the adjacent elements. No quadratojugal arch.

Pelycosauria. Two or three sacral vertebræ; centra notochordal; intercentra usually present. Dentition full.

Anomodontia. Four or five sacral vertebræ; centra not notochordal; no intercentra. Dentition very imperfect or wanting.

The *Rhynchocephalia* have no distal ischio-pubic symphysis, and apparently no epicoracoid bone. They have an obturator foramen, and a quadratojugal arch.

The order *Theromorpha* was regarded by Prof. Cope as approximating the *Mammalia* more closely than any other division of

[1] See Proceed. Amer. Philos. Soc., 1878, p. 511 and 528.

Reptilia, and as probably the ancestral group from which the latter were derived. This approximation is seen in the scapular arch and humerus, which nearly resemble those of the *Monotremata*, especially *Echidna;* and in the pelvic arch, which Owen has shown in the *Anomodontia* to resemble that of the Mammals, and as Prof. Cope pointed out, especially that of *Echidna*. The tarsus is also more mammalian than in any other division of reptiles. In the genus *Dimetrodon* the coracoid is smaller than the epicoracoid, as in Monotremes. The pubis has the foramen for the internal femoral artery.

The discovery of the *Pelycosauria* established the important fact that the first land Vertebrata possessed a *chorda dorsalis*.

A species of *Dimetrodon* was described under the name of *D. cruciger*. It is characterized by the enormous length of the neural spines of the lumbar vertebræ, which form the dorsal fin seen in other species of the genus. They are found in masses adhering together like sticks or branches of bushes. In this species the spine sends off, a short distance above the neural canal, a pair of opposite short branches, forming a cross. At various more elevated positions there are given off tuberosities which alternate with each other. They form on several consecutive spines oblique rows. The spines are broadly oval in section, the long axis antero-posterior, and have a shallow groove on both the anterior and posterior aspects. The centra are elongate as compared with their other diameters, and are much compressed between the articular extremities, leaving a strong inferior median obtuse rib. Articular faces of zygapophyses oblique. Diapophyses short and robust, with large costal faces, and standing below the prezygapophyses.

MEASUREMENTS.	M.
Diameter of centrum { antero-posterior	.043
Diameter of centrum { vertical at end	.028
Diameter of centrum { transverse at end	.030
Elevation of posterior zygapophyses above centrum	.025
" " cruciform process " "	.058
Expanse of posterior zygapophyses	.034
" " cruciform process	.048
Diameter of spine at base { antero-posterior	.030
Diameter of spine at base { transverse	.020
" " " .090 above base { antero-posterior	.016
" " " .090 above base { transverse	.016
Length of several pieces of neural spines	.140

Discovery of Recent Glaciers in Wyoming.—It was not known until during the past season that genuine glaciers existed within the limits of the United States, east of the Pacific coast, but last summer as two of the divisions of the Geological Survey under my charge were exploring the Wind River mountains in Wyoming Territory, we found living glaciers on the east side of the range. On the east base of the Wind River peak, which is at the south end of the range, there is a mass of snow and ice, 900 yards long and

500 wide, with all the elements of a true glacier. On the east base of Fremont's peak, which is over 14,000 feet high, we discovered two glaciers, one of which covers an area of one and one-fourth square miles, and the other three-fourths of a square mile. They were marked by enormous crevasses; also with lateral and terminal moraines. We called them Upper and Lower Fremont glaciers. These would appear to be only insignificant remnants of the vast glaciers that must have covered these mountains during the true glacial period. On the west side of the range, the moraines and glaciated rocks are found on a vast scale. On the west side of the range, a glacier must formerly have existed, eighty miles long and twelve wide, with the arms extending up the gorges of the streams to the very water divide. These glaciers will be more fully described in the 12th Annual Report of the U. S. Geological Survey.—*F. V. Hayden.*

Wasatch Group.—Along the east side of the Wind River mountains and filling up the Upper Wind River valley, is a great thickness of modern Tertiary strata that has been weathered into very remarkable forms, and which are known in the West as "Bad Lands." The strata are most beautifully variegated with various shades of pink or brick-red color, so that they sometimes remind one of the Jura-Trias red beds. This formation was described by me in 1859, in detail, and named the Wind River group. It covers a broad area in this region, extending from the source of Wind river to the Sweet Water mountains, south more than one hundred miles, and west an average width of one to five miles. The aggregate thickness of this group cannot be less than 5,000 feet. On the west side of the Wind River mountain, no formations older than the Wasatch group are found. This group rests, doubtless, on the Archæan nucleus, inclining at the base five to ten degrees. All the older sedimentary rocks have been entirely swept away from the granites for a distance of one hundred miles, while on the opposite or east side all the corresponding strata are visible from the Silurian to the Cretaceous; the Wasatch beds cover a large part of the Green River Valley, especially about its sources.

I am convinced, also, that a group of strata which I named in 1869, Gallisteo Sand group, in the valley of Gallisteo creek, a branch of the Rio Grande, is also the equivalent of the Wasatch group,[1] though both Wind river and Gallisteo Sand group as names have the priority over Wasatch, yet the latter has been now so much used in the Reports on Western geology, that it will probably prevent the use of the former to any extent in the future. When the Northwest is more fully explored, it will probably be found that the Wasatch group covers a large area extending more or less from our north line far into New Mexico.—*F. V. Hayden.*

[1] See Annual Report, page 177, reprint.

THE DEVONIAN AND SILURIAN FORMATIONS OF BRITTANY.—Dr. Chas. Barrois, of Lille, has published in the annals of the Geological Society of the North, for 1877, an account of his investigations into the geology of Brittany. He finds in the Devonian formation of that region, five well-defined horizons, some of which had been previously unknown in France. He discovered certain previously unsuspected relations between the formation, and that of the valley of the Lahn. At the Rode of Brest but three of these horizons are present, the second, third, and fifth. As regards the Silurian, Dr. Barrois finds the same horizons in Brittany that have been observed in other basins of the same formation. He, however, makes a number of rectifications of previous descriptions of the geology of Finistère.

THE GEOLOGY OF BELGIUM.—Much activity exists among the geologists of Belgium, and numerous articles have recently appeared, which advance the science in that country. The magnificent work of M. Van Beneden on the extinct Cetacea of the neighborhood of Antwerp, has reached the second part. M. Rutot has recently published an account of the fossils of the inferior Oligocene, and M. G. Vincent, the history of the Fauna of the Landenien inferieur. M. Rutot determines that the *Nipadites* and other fossil plants found in the neighborhood of Brussels, are derived from the Bruxellien, and not from the Lackenim as has been supposed. M. Lefèvre has discovered tortoises and *Halitherium* in the same region.

THE SOUTHERN BOUNDARY OF THE GLACIAL DRIFT.—In his Report as State Geologist of New Jersey, for 1877, Professor George H. Cook, presents some important facts relative to the southern limit of the glacial drift in that State. He finds it in a series of hills which cross the mouth of the Hudson river at the Narrows, and Staten Island Sound at Perth Amboy, which then extend northwards to near Morristown and Dover, and then westwards, crossing the Delaware river at Belvidere. These hills are composed of gravel, sand, boulders and stones commingled in a confused mass, and are identical in character with the material that fills the valleys to the north of them. The parent rock is in every case to the north, sometimes at a distance of twenty to thirty miles.

Professor Chamberlin, State Geologist of Wisconsin, presented to the Congress of Geologists recently held in Paris, a paper on the terminal moraine of the Great Lake District. Advance copies of the paper were printed in Paris. In this paper Professor Chamberlin describes an extensive belt of drift hills and ridges which traverse the quarternary deposits forming immense loops about the southern boundaries of the Great Lakes for a distance of 2000 miles in length, and a width of from one to thirty miles. Portions of this ridge had been observed by Lapham, Whittlesey, Andrews, and others. The material of the range consists of un-

stratified débris of all formations adjacent northwards, with some stratification of the surface of an irregular kind. A peculiar feature of the range is the presence of large holes and sinks, some of which are full of water. From these holes the range is called the Kettle Moraine. Its distribution is alike regardless of the geological and topographical features of the country, excepting in its parallelism to the southern border of the Great Lakes. Professor Chamberlin regards it as a terminal moraine which marks a period in the history of the glaciers which are supposed to have once filled the depressions now occupied by the Great Lakes.

MIOCENE VERTEBRATA OF OREGON.—An examination of a collection of vertebrate fossils from the John Day river, Oregon, recently made by Prof. Cope, yielded the following species: Artiodactyla—*Hypertragulus calcaratus* Cope, *Leptomeryx evansi* Leidy, *Eucrotaphus superbus* Leidy, *E. occidentalis* Marsh, *Merycocharus leidyanus* Bettany, *Hyopotamus guyotianus* sp. nov., *Thinohyus socialis* Marsh, *T. lentus* Marsh, *Elotherium imperator* Leidy. Perissodactyla—*Rhinocerus pacificus* Leidy, *Anchitherium equiceps* sp. nov., *A. brachylophum* sp. nov., *A. longiceristis* sp. nov., *Dæodon shoshonensis* gen. et sp. nov. (allied to *Chalicotherium*). Carnivora—*Canis gregarius* Cope, *C. lippincottianus* Cope, *C. cuspigerus* sp. nov., *C. geismarianus* sp. nov., *Temnocyon altigenis* gen. et sp. nov., *Machærodus strigidens* sp. nov, *M. brachyops* sp. nov. Rodentia—*Meniscomys hippodus* gen. et. sp. nov., *M. multiplicatus* sp. nov., *Pleurolcus sulcifrons* gen. et sp. nov., *Entoptychus cavifrons* gen. et sp. nov., *E. planifrons* sp. nov., *E. crassiramis* sp. nov., *Steneofiber* sp., *Steneofiber gradatus* sp. nov., *Palæolagus haydeni* Leidy.—*Proceedings of the Amer. Philosophical Society.*

GEOGRAPHY AND TRAVELS.[1]

THE AMAZON.—In the September number of the NATURALIST mention was made of the survey of the Amazon and Madeira rivers, undertaken by the U. S. corvette *Enterprise*, Commander Selfridge. This vessel arrived at New York on the 25th of September last, and we learn from the New York *Herald* of the successful accomplishment of her mission. At Serpa, near the mouth of the Madeira they found the Amazon a mile in width and sixty feet deep. The Madeira is here about two miles wide, and its principal channel has a depth of from ninety to sixty feet, according to the season of the year. From near its mouth to the falls its banks are high and well marked. The steamer entered the Madeira on the 17th of June, and advanced without difficulty at the rate of twenty-five miles a day, stopping at night, until the 21st, when near the island of Araras the pilots reported rocks and shoals. Although careful investigation proved that no rocks were there, and five fathoms of water was found, it was not deemed advisable for the ship to cross, owing to the reports of

[1] Edited by ELLIS H. YARNALL, Philadelphia.

the pilots and natives of the great and sudden changes in the rise and fall of the stream. The survey was, however, continued by the steam launch to San Antonio, a distance of about 325 miles, with the exception of the last thirty miles, which was, owing to an accident to the launch, made by Capt. Selfridge and Lieut. Perkins on board a Brazilian merchant steamer. Leaving the *Enterprise* on the 25th of June, the surveying party were again safe on board on the 20th of July. The results of their observations show that a navigable channel for ships drawing up to sixteen feet of water exists from the mouth of the Madeira to San Antonio, a distance of 500 miles. This channel is passable during nine months of the year, but during the time of low water, namely, August, September and October, the river is so low that in many places not more than six or eight feet can be carried. The adjacent territory is very thinly populated. Large quantities of rubber are collected and shipped along the river, and also copaiba, sarsaparilla, copal and chouta, a black odoriferous gum used as a cement.

Arctic Exploration.—The schooner *Florence*, Capt. Tyson, which was fitted out and sent by Capt. Howgate to Cumberland Gulf to procure skins, dogs, sledges and other material for the use of his expedition, has returned home, and from a dispatch by Capt. Tyson to the New York *Herald*, we learn that he sailed from New London on the 2d of August, 1877, and reached the Gulf after a tedious voyage of forty-one days. Here they remained in Niantilic harbor, latitude 65° 10′ north, longitude 67° 30′ west, until October 1st, when they removed to Annatook harbor, at the head of the Gulf. There they passed the winter and spring. On the 19th of July they sailed for Disco island, taking with them fifteen Esquimaux, men, women and children, twenty-eight dogs, a fair quantity of skin clothing and a great many skins. Arriving at Disco on July 31st, they remained until August 22d, when no intelligence of the expedition being received, they returned, after a difficult passage through the ice off Cape Mercy, to the Gulf. After discharging the Esquimaux they started on their voyage home on the 2d of September. Messrs. Kumlin and Sherman, the scientific members of the party, were very successful in the performance of their duties. The former has secured a large number of specimens, and the latter, aided by two of the crew, took hourly observations during the winter. The season has been a bad one. Melville Bay has been entirely blockaded by the ice, no whalers having been able to penetrate it, and the Danish ships have been unable to reach the upper settlements.

Results of the Recent British Arctic Expedition.—Sir George Nares has, in his "Narrative of a Voyage to the Polar Sea," recently published, given more fully his reasons why he

believes it is impracticable to reach the Pole by the Smith Sound route. The heavy polar pack, formed of ice from 80 to 100 feet in thickness, is rendered almost impassable by dense hummocks from 20 to 40 feet in height, or floes of most uneven surface covered with deep snow. North from Cape Joseph Henry, in latitude 83°, no land exists as far as the 84th degree, and he believes there is none for a distance of 200 miles.

Whether or not land exists within the three hundred and sixty miles which stretch from this limit to the northern axis of the globe is, so far as sledge traveling is concerned, immaterial. Sixty miles of such pack, Capt. Nares holds to be an insuperable objection to traveling in that direction with our present appliances.

The Polar sea extends along the northern coast of Grinnell land westward for a distance of at least two hundred miles, when the coast trends to the south-west, and no land further north is accessible by a sledge expedition in that direction. Entrance to all bays or harbors westward of Cape Joseph Henry is also barred by the Polar ice-wall. A similar barrier of ice exists along the North Greenland coast, so that no ship can hope to find protection on either of these shores.

Capt. Nares also regards the similarity in the character of the ice, and the formation of the coast of Banks land and Prince Patrick's island, to that of Grinnell land as evidence that the Polar sea extends to their shores, but the reverse conditions existing on the northern shore of the Parry islands indicates the extension of Grinnell land more or less continuously for the whole distance to Ireland's Eye, protecting the Parry islands from the Polar ice. It is, however, probable that Jones' sound affords the most direct route from Baffin's bay in a north-westerly direction to the Polar sea, separating Grinnell land from the land which protects the Parry islands.

From the "Abstract of Tidal Observations," by Dr. Samuel Haughton, we learn that the new tidal wave observed on board both the *Alert* and *Discovery* is *specifically* distinct from the Baffin's bay tide, and from the tide that enters the Arctic ocean through Behring's straits; and it is, without question, a tide that has passed from the Atlantic ocean round Greenland northwards and then westwards. Greenland probably ends not far north of latitude 82° or 83°.

GEOGRAPHICAL NEWS.—The deep sea soundings taken on board the U. S. Coast Survey steamer *Blake* during her voyage in the Gulf of Mexico, mentioned in our September number, were made about the south-east of the Gulf, about the Florida bank, west of the peninsula of the same name, about the Yucatan bank, and north-west of that peninsula and in the intervening portion of sea between the above-mentioned places and the western end of the island of Cuba. Prof. Alexander Agassiz who conducted these

investigations obtained surprisingly rich zoölogical results. The deepest sounding was taken between the Tortugas and the northeast cape of Yucatan (Cape Catoche) and was 1,920 fathoms; the next deepest being 1,568, north of the same. All depths of water of about 600 fathoms and upwards gave a uniform temperature of 39.5° Fahrenheit.

A correspondent of the New York *Tribune* gives an account of the results of a recent careful survey of Newfoundland under the superintendence of a Geological Commission. The area of the island is now found to be 42,000 square miles. It is 317 miles in length and 316 miles in breadth. It is, therefore, the tenth largest island in the world, and contains 10,000 square miles more than Ireland. Nor is there to be found an equal area with such an extent of coast line as Newfoundland, which, according to the Surveyor's report, cannot be less than 2,000 miles in length.

Prof. F. V. Hayden, in charge of the U. S. Geological Survey of the Territories, has recently been elected foreign member of the Royal Academy of Sciences, Letters and Arts, of Palermo, Sicily.

The English Palestine Exploration Fund has successfully accomplished the survey they began, in 1872, of all Palestine west of the Jordan. The scientific results of this survey are to be made public in a series of memoirs. The map is to be on the scale of one inch to a mile. The portion east of the river was assigned to the American Expedition, and is not yet completed.

MICROSCOPY.[1]

National Microscopical Congress (*Continued*).—Dr. R. H. Ward spoke at some length in regard to "Recent Progress in Microscopic Ruling," referring chiefly to the recent work of Mr. Charles Fasoldt, of Albany, and of Professor Wm. A. Rogers, of Cambridge. Mr. Fasoldt's experiments in ruling commenced during the middle of last winter, and must be regarded as remarkable considering the fact that he was entirely unfamiliar with the microscope and its use, and knew nothing of what had been done or could be done in microscopic ruling. Being a manufacturer of chronometers, he possessed the advantage of great skill in small mechanical operations and some experience in handling gems. He first, at the casual suggestion of a friend, undertook to make circular rulings, described with a common lathe and spaced with the slide-rest; and in this manner produced fair concentric circles as close as $\frac{1}{50000}$ of an inch. Parallel straight lines of equal closeness, but not of equal excellence, were then made on the same lathe, both the spacing and the ruling being accomplished by the motions of the slide-rest. Dissatisfied with this result, a screw machine was extemporized, and much closer lines of much better quality were produced. Some of the bands ruled with this little screw were better than many of the commercial

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

micrometers, though not to be compared with the work of Nobert or of Rogers. The screw was then abandoned, and the machine prepared with which the present work is done. Unfortunately, the maker is unwilling to give further information about this machine than that it has other than a screw motion, intimating, perhaps, that the spacing is accomplished by a lever movement. The finest bands are ostensibly ruled to $\frac{1}{120000}$ inch,[1] but it may be considered doubtful whether they are ruled according to the reading of the machine that made them. The bands up to $\frac{1}{80000}$ inch have been reported correct by authority that ought to be competent to judge, and the whole series is worthy of careful study by those who are expert in such work. Of a very different class is the progress made by Professor Rogers during the past year. The stage micrometers hitherto used as a basis of micrometry have scarcely claimed to possess a definite degree of accuracy. The speaker had used for years a standard obtained by comparing about two hundred micrometers ruled in different parts of the world, rejecting the few that from their wide deviation from the average were presumably erroneous, and averaging the remainder. Probably such a standard, though unsatisfactory, because of uncertain value, was as nearly safe as anything heretofore attainable. To obviate this uncertainty, Professor Rogers determined to derive a standard inch, with a precision not known to have been obtained before, from "Bronze bar No. 11," which has been the authorized standard in this country since 1855, having been presented to the United States by the British Government as one of the five original duplicates of "Bronze 19" the only English standard since the "standard yard of 1760" was destroyed by fire, and to derive a standard centimetre from the iron bar now in possession of the United States Coast Survey, one of the original standard metres, and the best representative in this country of the platinum metre deposited in the Archives of Paris. He fitted a glass bar forty-two inches long, one inch wide and one and a quarter inches thick, into an iron frame, the surfaces being made as true a plane as possible. With a diamond in a graduating engine he laid off upon it one hundred centimetre divisions. He then took the bar to Washington where the said lines were compared with the standard metre, and where the British yard and the Archives metre were transferred from the Saxton comparator of the United States Coast Survey to both the glass bar and its iron frame. The errors of the subdivisions of the yard, and of the metre, were investigated by means of a comparator constructed for the purpose of subdividing any unit into equal parts. The corrections for each subdivision having been determined, a number

[1] Mr. Fasoldt's finest lines are now made in twelve-band plates, the lines of the lowest band being 1–10,000 of an inch apart, of the next band 1–20,000 inch, of the next 1–30,000, and so on, increasing 10,000 to the inch each time to the twelfth band, which, if successfully ruled, has lines spaced to 1–120,000 inch. These plates can be made at as low a price as $15.00.

of copies of that division as corrected are ruled, and the one selected which corresponds most nearly with the computed correction. A similar process is applied to each subdivision, and finally these subdivisions are compared among themselves, and the one selected which is nearest the mean of the whole number. Thus the $\frac{1}{36}$ of a standard yard, and the $\frac{1}{100}$ of a standard metre, have been obtained with a certainty not believed to have been secured before. The standard centimetre thus produced by Prof. Rogers was submitted to the Congress for the use of members who might desire to determine the value of the divisions of their micrometers in terms of the Coast Survey standard.

Prof. J. D. Hyatt, of New York, gave a very interesting address on "The Sting of the Honey-bee," illustrated by a large number of diagrams. His paper, with its illustrations, will be published in the forthcoming number of the new quarterly.

"On the Construction of Oculars," by Wm. H. Seaman, of Washington. The discrepancies in published statements in regard to oculars, led the author to make a full series of measurements of the parts of eighteen oculars by English and Continental makers, and to present the results in a tabular form. By inspecting the table it appears that the common ratio between the focal lengths of eye lens and field lens is $\frac{1}{2}$, in one instance it is $\frac{1}{3}$, and in one of older construction $\frac{1}{5}$. The only general principle in regard to the interval separating the lenses is, that it shall be less than the solar focus of the field lens; and when in the deeper oculars, and those which are orthoscopic, it seems to exceed this limit, it must be remembered that in connection with the objective the ocular receives diverging rays, and for such, its focus is beyond the solar focus. It may also be noticed that but a small part of the diameter of the eye lens is actually used in the lower powers.

Prof. J. E. Smith made some remarks on "Micrometer Rulings," repeating his claim, formerly published, as the first to have resolved Nobert's 19th band, by reflected light. He also expressed the belief that he had resolved by reflected though not by transmitted light bands of $\frac{1}{120000}$th inch ruled, or attempted to be ruled, by Rogers.

"A New Turn-table" was exhibited and described by John W. Sidle, of Philadelphia. This table is self-centering by the Cox method, having jaws that press diagonally toward the center of the slide. Instead of the screw movement of the original form, or the lever or scroll screw of later modifications, the jaws are mounted near the edges of two small circular discs which are set into the main plate or table, on opposite sides of the center, and which by revolving simultaneously change the distance of the jaws from the center of the table. The mechanism seemed unlikely to get out of order, and a very steady and prompt motion was attained.

Prof. William Lighton, of Ottumwa, Iowa, described a "New Arrangement for Dark-field Illumination," in which an effect comparable to that of a spot-lens was produced by placing above the eye-piece a diaphragm with an aperture of $\frac{1}{16}$ inch, decentered so as to cut off the central cone of light ordinarily used by the eye. This effect is produced most perfectly with an achromatic eye-piece. He also described "An Analyzing Eye-piece," containing a bundle of reflecting plates arranged at a polarizing angle.

Dr. R. H. Ward gave an account of recent improvements in "Biscoe's Section Cutter." The principles of construction of this machine, which is said to have been founded on some German inventions, were fully explained in the NATURALIST for Jan., 1874. As now made by Mr. L. Schrauer, of New York, it has a central cylinder and plunger like other section cutters. In this way the object to be cut is arranged with great facility, while the thickness of the sections is regulated with ease and precision by the screws that support the carriage. This arrangement has a capacity for easy and good work that is almost incredible to persons accustomed to use other contrivances.

A communication on "Seiler's Section Cutter," by Wm. H. Walmsley, was read by title in the absence of its author.

A paper on "Epithelium" was read by Dr. W. H. Atkinson, of New York.

After referring the question of publishing proceedings to the executive committee, and passing an appropriate vote of thanks for favors received at Indianapolis, the Society adjourned until the Buffalo meeting.

NEW FORMS OF MOUNTING.—The cement which is essential to these processes, and which I regard as the most important working material of the microscopist, is shellac varnish prepared in the following simple manner: The white purified gum shellac is dissolved in alcohol and filtered through cotton one or more times until it is quite clear and transparent. As the filtering is to most persons a somewhat difficult operation, they had better perhaps let the druggist make this preparation for them. With this cement I build up a cell as deep and perhaps as quickly as one can be made with a curtain ring, painted up as it usually is. As much as one or two drops can be put on a slide with a brush, using the turn-table, and then slowly worked up into a narrow ring with the point of a small knife-blade held on the turning slide. When this has dried a day or two, another layer can be put on and worked up in the same way. Three or four such layers will be sufficient for almost any cell, and it can then be dried in the heating oven and laid aside for future use.

By carrying along a dozen or two slides at once, one will find great economy both of time and labor. These rings being transparent are admirably adapted for opaque mountings, with which it is desired to use the Lieberkühn.

If common curtain rings are fastened to slides with shellac cement, colored with aniline blue, the joined edges of the brass film of which the ring is made being on the glass, and then subjected to a slowly increasing heat until the cement begins to burn, a very beautiful ornamentation is given to the under side of the ring, a circle of minute golden links making their appearance there. These rings can then be painted according to fancy on the turn-table and used for any kind of mounting.

I use this cement, colored with the various aniline dyes which are soluble in alcohol, for painting and finishing slides. These colors are far superior, for all purposes of ornamentation, to any other material or devices for painting; they dry quickly and adhere to glass with greater tenacity than any other cements that I have ever used.

For a cell that will perfectly withstand the action of Canada balsam or turpentine, I make use of the shellac cement colored with aniline blue, in the following manner: After a cell of the required depth is made on the slide and pretty thoroughly dried in the usual way, it is heated on the heating table, slightly at first in order to avoid bubbles, then gradually increasing the heat until the cement commences to smoke and the color to burn out. By heating one side of the ring a very little more than the other, as may be done over an alcohol lamp, a part may be left blue while the other is yellow or reddish, which has a very pretty effect under Canada balsam. These cells are hard as bone, and can scarcely be cut from the glass. Balsam has no effect whatever on them. Mountings on them may be finished off with liquid balsam, made true and circular with the point of a knife on the turn-table. In a few days, or in a shorter time by using the oven, they will be ready to clean and lay away. The cells which I have described are the only cement cells that can be used with Canada balsam. They are particularly adapted to vegetable stainings, algæ, and all other preparations either too thick or too tender to be mounted in balsam without something to sustain the thin glass covers.

In opaque mountings when cements of any kind are used, either for back-ground or to hold the object in place, I have found it highly advantageous to leave on, or in the lower part of the ring, a minute aperture opening into the cell, not necessarily larger than a cambric needle would make. With this provision both the cell and the cement go on drying, and there is no sinking in or moving about of the objects in the medium which holds them. If the cell be hermetically closed, one may expect that the object will, sooner or later, be overwhelmed in a black sea. If curtain rings are used, a little notch can be filed in the side of them, and this be left open when the slide is finished.

If the opaque mountings are for dry objects, I make in the center of the ring a disk of Brunswick black or white zinc, accord-

ing as the object to be shown is white or black. It may be $\frac{5}{16}$ of an inch in diameter for the Lieberkühn of the $1\frac{1}{2}$ inch objective, but not over $\frac{1}{4}$ inch for that of the $\frac{2}{3}$ objective. After the cement is dry and quite hard, a thin coat of balsam is spread over it and the objects placed in this and arranged if necessary under the microscope. The slide is then set aside to dry and may safely be covered the next day. If the object to be mounted will bear immersion in balsam, as some shells, seeds, minerals, etc., I pursue the following plan: The thin glass covers are cemented to some old slips, kept for the purpose, by two or three touches of the balsam applied to the edge of the cover, care being taken to center the cover on the slip by means of the self centering turn-table. The objects are then arranged on a light coating of balsam on the center of the cover. When quite dry they should be completely covered by balsam and thoroughly hardened in the drying oven. Then Brunswick black or white zinc may be spread over the object, in thin layers at first, each being dried in the open air for a day before putting on the next, until an opaque covering is made for the object. Thoroughly clean the cover around the objects and then remove it from the slip by a slight heating. Then turn it over and mount it upon the cell prepared for it. Fasten the cover to the cell with gelatine softened by water to the consistency of jelly and then liquified by alcohol. Put the cover on the cell and apply the gelatine solution with a brush around the edge, leaving the little opening before referred to. When dry the cell may be finished with liquid balsam, carefully avoiding the little aperture. The outer edge may be gathered up into a neat trim circle with the point of a knife on the turn-table. —*C. C. Merriman, Rochester, New York.* (*Read at the National Microscopical Congress at Indianapolis, August,* 1878.)

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SCIENTIFIC NEWS.

— British Association for the Advancement of Science. We conclude our account of the last meeting, which was, on the whole, one of the largest, most varied and pleasant that has been held for twenty years. Several of our American scientists read papers. Prof. T. Sterry Hunt made communications on the Metamorphic or Archæan rocks of America as compared with those of Great Britain, and also on the geological relations of the atmosphere. Prof E. D. Cope read papers on the Saurians of the Dakota formation of the Rocky mountains, and on the Vertebrata of the Permian formation of Texas. Mr. Graham Bell made a communication on the Telephone. Prof. Cook, State-geologist of New Jersey, was also present. Of the papers of special interest, we note one in the zoölogical section by Sir Victor Brooke on the deer; a good point he made was the existence of a constant variation in the horn of *Cervus dama*, which

originated in an old buck, and now characterizes the entire herd in one park in West Ireland.

In physiology a good paper was the one on the location of sounds in the head on application of tuning-forks, telephone, microphones, etc.

In zoölogy another good paper was by Dr. Traquair on the structure of *Ctenodus* and *Dipterus*, in which he showed that the head of the latter is covered with segmented scuta like the sturgeon; the author brought out many other important points.

In general it may be remarked that the conduct of the meetings of the Association is very similar to that of our own. The tendency to complimentary criticism was probably rather more largely developed, but this did not prevent the fullest expression of adverse opinions when such were entertained.

As a good example of one of the evening lectures we quote, in part from the Dublin *Irish Times*, an abstract of Mr. J. G. Romanes' lecture on "Animal Intelligence," which attracted special interest; he said: "We thus see animal instincts may arise in either of two different ways, on the one hand, they may arise from the performance of actions which were originally intelligent, but which by frequent repetition have become automatic; and on the other hand, they may arise from survival of the fittest, preserving actions, which, although never intelligent, happen to have been of benefit to the animals which first chanced to perform them. But now let it be observed that although there is a great difference between these two kinds of instincts if regarded psychologically, there is no difference between them if regarded physiologically; for, regarded physiologically, both kinds of instincts are merely expressions of the fact that particular nerve-cells and fibres have been set apart to perform their reflexes automatically—that is, without being accompanied by intelligence. In making these observations we are not necessarily committing ourselves to the doctrine of materialism. That physiological phenomena are intimately connected with natural phenomena does not admit of doubt, but concerning the nature of this association scientific men declare not merely that it is at present unknown, but that, so far as they are at present able to discern it must forever remain unknowable. The restless tide of intellect for centuries has onward rolled, submerging in its arms those rugged shores whose name is mind, but at the lines where mind and matter meet there arises a mighty history like a frowning cliff, and in the darkness of the place we hear the voice of true philosophy proclaim: 'Hitherto shalt thou come, but no further, and here shall thy proud wave be stayed.' So much then for what I have called the physiological basis of mind. Passing on now to our review of comparative psychology, the first animals in which so far as I can ascertain we may be quite sure that reflex action is accompanied by ideation, are the insects. Well, remembering this distinction,

we shall find that the only difference between animal intelligence and human intelligence consists in this—that animal intelligence is unable to elaborate that class of abstract ideas the formation of which depends on the faculty of speech. In other words, animals are quite as able to form abstract ideas as we are, if under abstract ideas we include general ideas of qualities which are so far simple as not to require to be fixed in our thoughts by names." The lecturer also proceeded to show that animals had reason and judgment. "Passing on to the emotional life of animals, we find that this is very slightly, if at all, developed in the lower orders, but remarkably well developed in the higher; that is to say, the emotions are vivid and easily excited, although they are shallow and evanescent. They thus differ from those of most civilized men in being more readily aroused and more impetuous while they last, though leaving behind them but little trace of their occurrence. As regards the particular emotions which occur among the higher animals, I can affirm from my own observations that all the following give unmistakable tokens of their presence: Fear, affection, passionateness, pugnacity, jealousy, sympathy, pride, reverence, emulation, shame, hate, curiosity, revenge, cruelty, emotion of the ludicrous and emotion of the beautiful. Now this list includes nearly all the human emotions, except those which refer to religion and to the perception of the sublime. These, of course, are necessarily absent in animals, because they depend upon ideas of too abstract a nature to be reached by the mind when unaided by the logic of signs. Time prevents me from here detailing any of my observations or experiments with regard to the emotional life of animals, so I will pass on at once to the faculty of conscience. In highly intelligent, highly sympathetic and tolerably well treated animals the germ of a moral sense becomes apparent. On the whole, therefore, I can only suppose that we have in these actions evidence of as high a development of the ethical faculty as is attainable by the logic of feelings when unassisted by the logic of signs; that is to say, a grade very nearly if not quite as high as that with which we meet in low savages, young children, many idiots and uneducated deaf mutes. In savages, as in animals, there was a remarkable tendency to act in accordance with performed habits rather than to strike out improved modes of action. Very young children present only those lower faculties of mind which in animals we call instincts. With advancing age, the first indication of true intelligence seems to consist in the power of forming special associations. On the general theory of evolution we should expect that in such a descending scale the characteristically human, or the more recently developed faculties should be the first to disappear, while those faculties which man shares with the lower animals should be the more persistent. And this expectation I have found to be fairly well realized. Beginning from

below, the first dawn of intelligence in the ascending scale of idiots, in the ascending scale of animals, is invariably to be found in the power of associating simple concrete ideas. Thus there are very few idiots so destitute of intelligence that the appearance of food does not arouse in their minds the idea of eating; and, as we ascend in the scale idiotic, we find the principle of association progressively extending its influence, so that the mind is able, not only to establish a greater and greater number of special associations, but also to retain these associations with an ever increasing power of memory. In the case of the higher idiots, as in the case of higher animals, it is surprising in how considerable a degree the faculty of special association is developed notwithstanding the dwarfed condition of all the higher faculties. On the whole then, from the mental condition of uneducated deaf mutes, we learn the important lesson that in the absence of language the mind of man is almost on a level with the mind of a brute in respect of its power of forming abstract ideas.

The Association will meet next year at Sheffield, under the presidency of Prof. Allman.

— The Congress of Geologists at Paris. The existence of this body is due, firstly, to the exertions of a committee which met in Philadelphia during the Exposition of 1876; and secondly, to the energetic coöperation of the Geological Society of France, which took in charge the arrangement of the details of the organization. The officers selected by this body and elected by the Congress on its opening, were the following: president, M. Hébert; vice-presidents, England, M. Davidson; Belgium, De-Koninck; Canada, Sterry Hunt; Denmark, Johnstrupp; Spain, Villanova; United States, Hall; France, Daubrée and Gaudry; Hungary, Szabo; Italy, Capellini; Holland, Von Baumhauer; Portugal, Ribeiro; Roumania, Stephanescu; Russia, De Moeller; Sweden, Thorell; Switzerland, Favre; general secretary, Jannetaz; secretaries, M. Brocchi, Delaire, Sauvage and Vélain; treasurer, M. Bioche.

The Congress assembled on Thursday, the 22d August, in the large hall above the commencement of the left wing of the Trocadero. To such of our readers as have not seen this building it may be interesting to remark, that it is situated on the side of a hill on the right side of the Seine, which slopes gently towards the bank of the river. It faces the main building of the Exposition which stands on the left bank, the two being connected by ornamental grounds, and by the bridge of Jena. The building consists of a central portion of the form of a semicircle to which are added two long arm-like wings, which follow the direction of the circumference of a large circle for perhaps 120°. The convexity of the central building is inwards, and presents several porticoes, one above the other. From the summit of the lowest of these a wide sheet of water descends with a face con-

vex transversely, and is received into a basin. From this the water flows by a succession of falls to a large basin below, which is adorned with numerous fountains. At four points in its circumference are the gilded figures, of life size, of four prominent species of animals—the elephant, horse, ox and rhinoceros. On each side of the staircase of waterfalls is a series of small fountains composed of very many fine jets of little elevation, the whole producing the effect of tufted vegetation.

The hall of meeting is well adapted for the use of the Congress, which includes a membership of two hundred and fifty persons. The proceedings of the first day, August the 29th, opened with an election for officers, which resulted in the selection of the names above enumerated. An allocution from Prof. James Hall, of New York, president of the committee of Philadelphia, followed. The report of this committee succeeded, and the organization was completed by the announcement of the names of the officers elected.

The papers announced for the opening day were the following: 1. M. Daubrée, Etudes expérimentales sur les déformations et les cassures de l'écorce terrestre. 2. M. A. Favre, Sur les expériences relatives aux effets de refoulements latéraux en géologie. 3. M. De Chancourtois, Représentation et coordination des faits d'alignements (Failles et Filons). 4. M. De Lapparent, Les plissements de la craie entre la France et l'Angleterre à propos du chemin de fer sous-marin. 5. M. Gorceix, Sur les gisements aurifères et sur les pierres précieuses du Brésil.

The papers for the 30th of August were the following: 1. M. James Hall, On the Nomenclature of American palæozoic rocks and the construction of geological maps. 2. M. Stephanescu, Nomenclature géologique uniforme pour tous les pays en ce qui regarde les terrains et les étages. 3. M. Van den Broeck, Valeur des termes de l'échelle stratigraphique du globe. 4. M. Renevier, Rapport sur l'emploi des couleurs et des termes désignant les subdivisions des terrains. 5. M. Rutot, De l'adoption des subdivisions uniformes pour les terrains tertiaries. 6. M. De Chancourtois, Unification des conventions pour les cartes gélogiques. 7. M. Villanova, Bases d'un dictionnaire de géologie. 8. M. l'Abbé Almera, Réimpression des ouvrages de paléontologie.

On the 31st of August the following papers were read: 1. T. Sterry Hunt, Limits of the Cambrian Formation. 2. De Moeller, Composition et subdivisions générales du système carbonifère. 3. J. P. Lesley, Limits of the Permian and Carboniferous in Pennsylvania. 4. Vélain, Phénomènes Geysériens dans le Trias de Morvan à propos de la délimitation du Trias et du Lias.

The following papers were read on the 2d of September: 1. Cope, Relations of horizons of Vertebrate Fossils of Europe and North America. 2. Gosselet, De la Synonomie des especes fossiles au point de vue du droit de priorité. 3. Rouault, Amorphozoaires

du Silurien inferieure de Bretagne. 4. DeMorillet, Divisions du Quaternaire. 5. Winkler, Origine des dunes sur le littoral de la Hollande. 6. Van den Broeck, Influence des phénomènes météoriques sur l'altération des Róches. 7. W. P. Blake, Geological Maps of the United States of North America. 8. Violet d'Aoust, Origine des volcans. 9. Bouejot (by M. Delesse), Calcaire blue eruptif. 10. Choffat, Mélanges d'horizons stratigraphiques par suite des mouvements du sol.

Papers of the 3d of September: 1. Des Cloizeaux, Microcline et Feldspaths tricliniques. 2. Michel Lévy, Emploi du Microscope polarisant à lumière parallèle pour l'étude des roches. 3. Jannetaz, Rapports de la propagation de la chaleur dans les roches et de leur structure, au point de vue de leur origine. 4. Vélain, Ses Roches trachytiques de la Réunion au point de vue de la classification. 5. Sterry Hunt, Terrains Precambriens de l'Amerique du Nord. 6. Szabo, Classification et chronologie des roches éruptives tertiaires de la Hongrie. 7. Ribeiro, Formation Tertiaire du Portugal. 8. Chamberlin, The Kettle Moraine of the Great Lake district of North America.

On September the fourth, the Council presented to the Congress several propositions, viz:

A committee to propose a system of coloration for geological maps.

A committee to propose a uniform nomenclature for geological horizons and formations.

A committee to investigate and report on a method of uniformity in nomenclature in palæontology.

That the second meeting of the Congress take place three years hence in Bologna, Italy.

That in the *interim* the present Council of the Congress transact its affairs.

Which propositions were, with slight modifications of their original forms, adopted by the Congress.

The sessions of the Congress were largely attended, and under the able ruling of Professor Hèbert, were conducted with dispatch and effect. The interest of the occasion was enhanced by the entertainments offered by the Department of Public Instruction and by private citizens. Of the former may be mentioned that at the Arts et Metiers, where the garden was illuminated by the Jablokoff lights, and the one at the residence of the Minister. Of the latter, the entertainments at the residences of Profs. Hèbert, Gaudry and Daubrée, will be remembered by those who attended them. After the adjournment of the Congress a banquet was held at the Hotel Continental.

A number of the members of the Congress remained to take part in the annual excursions of the Geological Society of France, which immediately followed.

— In his recent lecture on civilization and science, Prof. Du

Bois-Reymond asks that more science be taught in the German gymnasia, though he does not propose to convert the gymnasium into a school for science-teaching. "All that I ask is that as much shall shall be done to meet the wants of the future physician, architect or military officer as those of the future judge, or preacher, or teacher of classical languages. Thus I ask for only so much natural history in the lower classes of the school as will awaken the faculty of observing, and that facilities be given for familiarizing the lads with the methods of classification which is rooted in the depths of the understanding, and whose educational force is so eloquently described by Cuvier. Let Darwinism, of which I am myself an adherent, be excluded from the gymnasium. In the higher classes, for the reasons assigned in my report, I should like to have taught, not physics and chemistry with experiments, but mechanics, the elements of astronomy, also of mathematical and physical geography—to which studies one hour more than heretofore could be devoted without injury."

— In Von Ihering's recent work on the nervous system of molluscs, a new arrangement of the molluscs is given which may be novel to our malacologists, as the work itself is rather expensive. The genus Chiton and allies are associated with the worm Chætoderma and the doubtful form Neomenia, forming the Phylum *Amphineura*, as follows:

VERMES.

Phylum *Amphineura*.

Class 1. *Aplacophora* (Chætoderma, Neomenia).
" 2. *Placophora* (Chitonidæ).

The mollusca are thus arranged:

MOLLUSCA.

Phylum I. *Acephala* (Lamellibranchiata).
" II. *Solenoconchæ* (Scaphopoda).
" III. *Arthrocochlides* (Gastropoda, Prosobranchiata).
" IV. *Platycochlides* (Class 1. Ichnopoda, embracing the Nudibranchiata, Tectibranchiata and Pulmonata.)
" 2. Pteropoda.
" 3. Cephalopoda.

— A work on the songs of birds and other animals as related to human music, and as furnishing a basis for a theory of melody, is in course of preparation by Mr. Xenos Clarke, of San Francisco, Cal., who writes that "the chief impediment is the lack of recorded observations. I should be most grateful if you could kindly assist me in any of these ways, viz:

"1. References to books, etc., containing songs of birds or other animals in musical notation. (Copies of these would be still more valuable.)

"2. Results of your observations on birds or their songs.

"3. Is there noticed with any frequency in these songs the occurrence of any fundamental intervals of human music, as the octave, fifth, fourth and third?

"4. (A question only seemingly irrelevant.) If singing in the ears has ever happened to you, have any of the fundamental intervals, above mentioned, been observed between the minute tones?

"5. Any information that may occur to you as bearing on these subjects?" We refer the matter to our ornithological readers.

— The *Zoologischer Anzeiger*, published in Leipzig and edited by Prof. J. Victor Carus, proves to be a most useful periodical. The editor has two objects in view: besides giving digests of new works and articles, to make the literature complete as possible and to have the addresses of working and teaching zoölogists, zoötomists, anatomists and palæontologists, as full and trustworthy as may be. For this purpose he would like to receive the aid of American naturalists, and especially to receive copies of our journals and proceedings in exchange for his journal. The *Anzeiger* will, by and by, contain a list of public museums, institutes, etc., which are not connected with universities and colleges. As the journal is published fortnightly, men of science will find it the most convenient way of publishing quickly short preliminary abstracts of new researches of all kinds relating to zoölogy.

— The New York Academy of Sciences begins its sessions for the winter in its new rooms, handsomer and more attractive than its previous quarters. The library of the Academy has been moved up town into rooms granted for it, in the new (fire-proof) building of the American Museum of Natural History, where it is to have the best care and accommodations and remains subject to the control of the Academy.

— The eleventh annual meeting of the Kansas Academy of Science was held at Topeka, on October 8th and 9th, with an attendance larger than in previous years. The number of papers presented was also larger than usual. Prof. B. F. Mudge, of Manhattan, was elected president, and E. A. Popenoe, of Topeko, secretary, for the ensuing term of one year.

— Recent arrivals at the Philadelphia Zoölogical Garden: 1 water snake (*Tropidonotus sipedon*), New Jersey; 2 capybaras (*Hydrochœrus capybara*); 1 dourocoul (*Nyctipithecus trivirgatus*); 1 capucin (*Cebus apella*), South America; 2 bonnet macaques (*Macacus radiatus*); 2 rhesus monkeys (*Macacus erythræus*); 1 common macaque (*Macacus cynomolgus*), India; 5 Guinea baboons (*Cynocephalus sphinx*), West Africa; 1 large alligator (*Alligator mississippiensis*), Florida; 1 European glass snake (*Pseudopus pallasii*), Austria; 5 copperheads (*Ancistrodon contortrix*), Pennsylvania; 1 green bittern (*Ardea virescens*); 1 golden-crowned thrush (*Seiurus aurocapillus*) Pennsylvania; 2 cinereous vultures (*Vultur cinereus*); 2 griffon vultures (*Gyps fulvus*), North Africa; 4 barn owls (*Strix flammea americana*); 2 Angora rabbits; 7 weeper capucins (*Cebus capucinus*), South America; 1 little brown bat (*Vespertilio subulatus*), New Jersey; 1 brown pelican (*Pelecanus*

fuscus), Florida; 1 rufous rat kangaroo (*Hypsiprymus rufescens*), born in the garden; 1 pig-tailed macaque (*Macacus nemestrinus*); 1 rhesus monkey (*Macacus erythræus*), India; 6 hog-nosed snakes (*Heterodon platyrhinus*); 1 garter snake (*Eutænia sirtalis parietalis*), Ohio; 1 opossum (*Didelphys virginiana*); 2 gray lizards (*Sceloporus undulatus*), New Jersey; 1 black snake (*Bascanion constrictor*); 1 water snake (*Tropidonotus rhombifer*), Illinois; 1 brindled gnu (*Catoblepas gorgon*), South Africa; 1 common quail (*Ortyx virginianus*); 2 whooping cranes (*Grus americanus*); 2 sandhill cranes (*Grus canadensis*), North America; 2 red coatis (*Nasua nasica rufa*), South America; 1 elk (*Cervus canadensis*), born in the garden; 2 tortoises (*Testudo tabulata*), South America; 1 gray squirrel (*Sciurus carolinensis*); 2 common hoopoes (*Upupa epops*), Europe, Asia and North Africa; 1 jackdaw (*Corvus monedula*), Europe and Asia; 1 sickle-billed curlew (*Numenius longirostris*), Atlantic States; 1 night hawk (*Chordeiles virginianus*), United States; 4 common chameleons (*Chamæleo vulgaris*), Europe, Asia and North Africa; 1 Yarrell's curassow (*Crax carunculata*), Brazil; 1 screech owl (*Scops asio*); 1 cat-bird (*Mimus carolinensis*); 1 green linnet (*Ligurinus chloris*); 1 chaffinch (*Fringilla cælebs*), Great Britain; 2 white-footed mice (*Hesperomys leucopus*), United States; 1 Savannah deer (*Cervus savannarum*), born in the garden.—*Arthur E. Brown, Gard. Supt.*

— American Naturalist. The numbers of this journal issued during the past year were published at the following dates: February, January 31st; March, February 23d; April, March, 19th; May, April 22d; June, May 22d; July, June 28th; August, July 27th; September, August 21st; October, September 23d; November, October 30th; December, November 29th. —*Editors.*

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

National Academy of Sciences.—The semi-annual meeting was held at New York, November 5–7. A report to Congress, recommending the future consolidation of the various geodetic, geographical and geological surveys of the United States, was adopted by the Academy. The following papers on natural science were read and discussed: The early types of insects, by S. H. Scudder; On the arrangement of the exhibition rooms in the Museum of Comparative Zoölogy at Cambridge; Arrangement of a zoölogical marine laboratory at Newport; On the embryology of the gar pike; On some of the zoölogical results of the United States Coast Survey Steamer *Blake*, by Alexander Agassiz; On some remains of new Dipnoan fishes and their relation to living forms; On some mooted points in American geology, by J. S. Newberry; On the characters of Theromorphous reptiles, by E. D. Cope; Note on the Two-ocean Pass, Wyoming Territory; On the discovery of recent glaciers in the Wind River mountains; Plan of a general geolog-

ical map of the Territories of the United States, west of the 94th meridian, by F. V. Hayden; Some remarks on an investigation of the laws of heredity, undertaken by the Board of Health of Massachusetts, by A. Hyatt; On the physical structure and hypsometry of the western Catskills, with some remarks on the whole group, by A. Guyot.

NEW YORK ACADEMY OF SCIENCES.—October 14. Prof. A. A. Julien read a paper on "Chemical erosion on mountain summits," in which he presented a large number of facts, drawn from personal observation among the mountains of North Carolina, and the Catskills and the Shawaugunks of New York, indicating the existence of a powerful agency of chemical erosion in connection with vegetable acids. He recalled the recently published articles of Prof. H. C. Bolton, read before the Academy, on the action of organic acids upon minerals, and their use as tests and reagents in mineralogy, and then presented his own observations, as tending to show that like processes are going on in nature on a great scale, particularly through the action of lunnic, intro-lunnic and ulmic acids upon silica. He described in detail the remarkable erosion of the Shawaugunk Grit, along the precipitous edge of the mountains of that name, in situations and ways which indicate that it can be only due to decomposing vegetation. The paper was discussed at length, and generally regarded as possessing great significance.

November 4. Prof. W. P. Trowbridge made a communication regarding disputed questions in animal locomotion.

AMERICAN GEOGRAPHICAL SOCIETY.—November 12. Rear Admiral Daniel Ammen, U. S. N., read a paper upon the proposed inter-ocean ship canal across the American Isthmus, between Greytown and Brits, via Lake Nicaragua; its feasibility as a commercial question, and its advantages as compared with other proposed routes.

BOSTON SOCIETY OF NATURAL HISTORY.—October 16. Prof. N. S. Shaler remarked on certain peculiarities in the structure of the swamp cypress (*Taxodium distichum*).

November 6. Mr. M. P. Kennard described the recently discovered glacial relics at Lucerne, Switzerland.

APPALACHIAN MOUNTAIN CLUB.—November 13. Prof. E. T. Quimby read a paper on Sun telegraphing, and Prof. E. C. Pickering remarked on a proposed system of mountain signalling.

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SCIENTIFIC SERIALS.[1]

THE GEOGRAPHICAL MAGAZINE.—November. The Afghan passes (with a map of the Kaibar, Karatcha and Kurram passes), by Trelawny Saunders. The Kuldja Question. Explorations in Greenland, by R. Brown. M. Ujfalvy's Travels in Central Asia.

THE GEOLOGICAL MAGAZINE.—November. The general history of the Cephalopoda, recent and fossil, by Miss A. Crane.

[1] The articles enumerated under this head are usually selected.